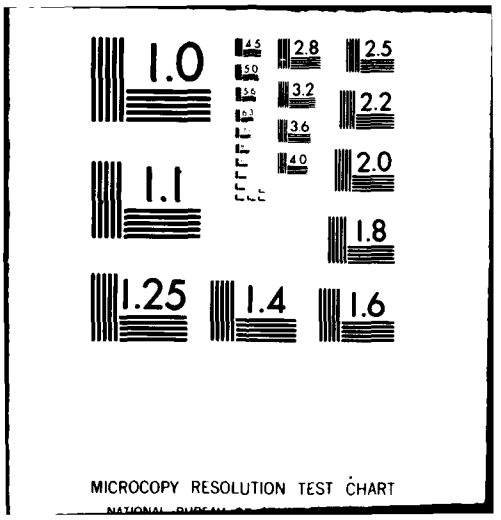
AD-A090 952 AKINC RESEARCH CORP ANNAPOLIS MD F/G 19/6
TECHNICAL AND MANAGEMENT SUPPORT FOR THE GUN WEAPON SYSTEM REPL--ETC(U)
AUG 80 N LAKIS N00174-79-C-0340
UNCLASSIFIED 1665-01-2254 NL


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART

(11) LEVEL II

Publication 1665-01-1-2254

TECHNICAL AND MANAGEMENT SUPPORT FOR THE GUN WEAPON SYSTEM REPLACEMENT PROGRAM

August 1980

Prepared for
MANAGER, SURFACE WEAPONS SYSTEMS MAINTENANCE BRANCH
NAVAL ORDNANCE STATION
INDIAN HEAD, MARYLAND 20640
under Contract N00174-79-C-0340

ARINC RESEARCH CORPORATION

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Date Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

(14) 1. REPORT NUMBER: 1665-01-1-2254

2. GOVT ACCESSION NO.: AD-A090 952

3. RECIPIENT'S CATALOG NUMBER:

(6) 4. TITLE (and Subtitle): Technical and Management Support For the Gun Weapon System Replacement Program

5. TYPE OF REPORT & PERIOD COVERED:

6. PERFORMING ORG. REPORT NUMBER: 1665-01-1-2254

(10) 7. AUTHOR(s): Nick C. Lakis

8. CONTRACT OR GRANT NUMBER(s): (15) N00174-79-C-0340

9. PERFORMING ORGANIZATION NAME AND ADDRESS:
ARINC Research Corp.
2551 Riva Road
Annapolis, Md. 21401

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: (11)

11. CONTROLLING OFFICE NAME AND ADDRESS:
Manager, Surface Weapons Systems Maintenance Branch
Naval Ordnance Station
Indian Head, Md. 20640

12. REPORT DATE: August 1980

13. NUMBER OF PAGES: 102

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): (12) 101

15. SECURITY CLASS. (of this report): Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT (of this Report)

Unlimited

DISTRIBUTION STATEMENT A
Approved for public release; Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Management Support
Gun Weapon Systems

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A 12 month period commencing on 14 August 1979, specific program areas of management responsibility were analyzed by ARINC Research Corp. to provide engineering and management support to NOSIH. This study presents the results of investigations into program areas that showed a high potential for (1) improvement to existing procedures and (2) coordination with the Destroyer Engineered Operating Cycle (DDEOC) Program and emergent Engineered Operating Cycle (EOC) programs.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Date Entered)

400247

TECHNICAL AND MANAGEMENT SUPPORT FOR THE GUN WEAPON SYSTEM REPLACEMENT PROGRAM

August 1980

Prepared for

Manager, Surface Weapons Systems Maintenance Branch
Naval Ordnance Station
Indian Head, Maryland 20640

under Contract N00174-79-C-0340

by

N. Lakis

ARINC Research Corporation
a Subsidiary of Aeronautical Radio, Inc.
2551 Riva Road
Annapolis, Maryland 21401

Publication 1665-01-1-2254

ABSTRACT

The Manager of the Surface Weapons Systems Maintenance Branch, Naval Ordnance Station, Indian Head (NOSIH) has been tasked to provide direct management support for the Gun Weapon System Replacement Program (GWSRP). During a 12-month period commencing on 14 August 1979, specific program areas of management responsibility were analyzed by ARINC Research Corporation to provide engineering and management support to NOSIH. This study presents the results of investigations into program areas that showed a high potential for (1) improvement to existing procedures and (2) coordination with the Destroyer Engineered Operating Cycle (DDEOC) Program and emergent Engineered Operating Cycle (EOC) programs.

Specific areas addressed included GWSRP OrdAlt accomplishment, on-line terminal installation supporting the GWSRP Management Information System (MIS), GWSRP-cognizant lifting gear capabilities at existing waterfront industrial sites, DDEOC (and emergent EOC program) Class Maintenance Plan (CMP) refinement, coordination of scheduling requirement of GWSRP with DDEOC and emergent EOC programs, and continuing engineering support to GWSRP. The conclusions and recommendations will provide program managers with guidelines for the coordination of their respective maintenance management activities and improvement to their current procedures.

SUMMARY

This report presents the results of a study to provide engineering and management support to the Gun Weapon System Replacement Program (GWSRP) and to provide continuing coordination of the GWSRP with the Destroyer Engineered Operating Cycle (DDEOC) Program and other emergent Engineered Operating Cycle (EOC) programs. The study was performed under Contract N00174-79-C-00340 for the Surface Weapons Systems Maintenance Branch, Naval Ordnance Station, Indian Head (NOSIH), Maryland. In support of the study objectives, the following areas of interest to the GWSRP were addressed:

- Gun weapon system modernization was investigated to determine the status of approved Ordnance Alterations (OrdAlts) scheduled for GWSRP equipments and components.
- An investigation into the proposed automation of the GWSRP Management Information System (MIS) data transfer was conducted to assist in the development and planning of program requirements concerning implementation of on-line terminal installations for the GWSRP MIS.
- An inventory of GWSRP-related equipment lifting gear was conducted to determine the capability of waterfront site facilities to perform removal and installation operations.
- DDEOC Class Maintenance Plans (CMPs) were reviewed to determine potential areas of refinement and to increase integration of scheduling requirements between the GWSRP, DDEOC, and emergent EOC programs.
- Continuing engineering support to improve the interprogram coordination between the GWSRP and EOC programs was provided.

The initial step of the analysis was to collect and evaluate applicable data and documents. Concurrently, potential opportunities to improve existing procedures addressed in each subtask were identified. Discussions were held with appropriate technical activities to gain further information and insight into the analyzed documentation and to discuss the preliminary findings. Tentative integration actions and procedural improvements were developed, analyzed, and again presented to the cognizant program managers for their review. Their comments were considered in the formulation of this report's conclusions and recommendations.

The major findings resulting from the analysis are as follows:

- The majority of budgeted Mk 42 Mod 9 gun mount OrdAlts are currently being accomplished by NOSL during overhaul. However, the present means of tracking OrdAlt accomplishment needs to be improved. Lines of communication should be kept open between Naval Ordnance Station, Louisville (NOSL) and other OrdAlt installing activities to ensure that configuration verification reports are kept accurate and up-to-date. In addition, procedures that ensure the proper verification of OrdAlts should be implemented.
- The present GWSRP MIS data exchange procedures are time-consuming. The GWSRP MIS should be automated to keep up with the additional workload foreseen with the future addition of new gun mount and fire control systems to the GWSRP. Automation should be effected by using existing computer hardware that can be made available to the GWSRP MIS managers.
- There is widespread use of lifting gear not in accordance with technical manual design specifications. In addition, weight-testing programs at many facilities need to be improved to ensure that the lifting gear is properly inspected and certified. Waterfront facilities required to perform gun weapon system removal and installation operations should be provided with lifting gear that meets technical specifications. Safety standards concerning the weight testing and proper certification of gun weapons system lifting gear should be reemphasized.
- CMP repair requirements for gun weapon systems specifying Class B overhaul of equipment are not sufficiently specific. Repairs should be in accordance with results of preoverhaul and availability inspections.
- The DDEOC Program has scheduled virtually all gun weapon system maintenance requirements for the SRAs and Regular Overhaul (ROH). The GWSRP should monitor and provide input to the DDEOC Program, because these maintenance requirements have a direct impact on GWSRP inspection and overhaul schedules.
- Considering the extended period required to accomplish all Gun Weapon System Improvement Program (GWSIP) OrdAlt installations at the various waterfront sites, a strong emphasis on installation coordination is necessary to assure proper introduction of the gun mount improvements to forces afloat. A 1981 fiscal year effort should be initiated to establish the necessary criteria for effective support of 3"/50 GWSIP waterfront installation coordination with Fleet activities.

CONTENTS

CONTENTS (continued)

CONTENTS (continued)

CHAPTER ONE

INTRODUCTION

1.1 GWSRP HISTORICAL BACKGROUND

The Gun Weapon System Replacement Program (GWSRP) was originated in 1964 by the Bureau of Naval Weapons as the Ordnance Replacement Program. The mission of the program was to provide a source of replacement for guns, fire control, and related equipment, most of which had been installed in the mid- to late-1940s and had reached a state of disrepair through extended service. Under the program, available gun mounts, computers, radars, and related equipment were overhauled in a depot assembly line operation and used to replace badly worn guns and related systems installed in the Fleet. Removed items were placed in a repair pipeline to keep the replacement cycle going.

Intensified use of gun mounts in the Southeast Asia conflict and a drastic reduction in rotatable pool assets contributed to increased maintenance requirements of the gun weapon systems (GWSs) and highlighted the need for an efficient GWSRP. To keep pace with the increasing volume and complexity of maintenance in an era of tightening defense budgets, the GWSRP planning process must provide for the most efficient utilization of existing resources that are available to the GWSRP managers. In addition, coordination efforts with other maintenance management programs, such as the Destroyer Engineered Operating Cycle (DDEOC) Program, should be pursued to minimize duplication of requirements and procedures and to maximize the effectiveness of the use of resources.

1.2 REPORT BACKGROUND

This report is the third analysis resulting from the initial study under Contract N00174-78-C-0105. That effort was directed toward developing recommendations that would improve coordination between the GWSRP and the DDEOC Program. The initial study identified areas of common interest between the GWSRP and the DDEOC Program and made recommendations for integrating these interests. ARINC Research Publication 1655-01-1-1779, dated June 1978, reported the results of that study. During the study

A050 925

seven areas were identified as prime candidates for analyses to improve maintenance management support of GWSs:

- Inspection procedures
- Bid specifications written for overhauls
- Baseline overhaul (BOH) repair requirements
- Management information system data exchange
- Material condition assessment procedures conducted by DDEOC site teams
- Class Maintenance Plan (CMP) requirements
- Program scheduling requirements

The first two areas were considered to be of the highest priority and were therefore treated in the first analysis under Contract N00174-78-C-0105. The results of that analysis can be found in ARINC Research Publication 1655-02-2-1818. The next three areas were included in a study conducted under Contract N00174-79-C-0035. The results of that analysis can be found in ARINC Research Publication 1661-01-1-2010. The last two of the seven identified topics, CMP requirements and program scheduling requirements, are included in this report, which was conducted under Contract N00174-79-C-0340. Thus this report represents the completion of the previously mentioned coordination efforts between the GWSRP and the DDEOC Program and other emergent Engineered Operating Cycle (EOC) programs.

In addition, this report contains analyses of areas that are of special interest to the GWSRP. These areas, identified as part of the continuing engineering and management support provided to the GWSRP under Contract N00174-79-C-0035, are as follows:

- Investigate the program status of approved Ordnance Alterations (OrdAlts)
- Provide technical assistance in developing and planning program requirements to implement on-line terminal installation supporting the GWSRP management information system (MIS)
- Investigate the capabilities of waterfront facilities to remove and install GWSRP cognizant equipment

1.3 STUDY OBJECTIVES

The objectives of this study are (1) to provide engineering and management analyses in support of GWSRP elements and (2) to provide continued engineering support for the coordination of the GWSRP and the DDEOC Program that can be applied to emergent EOC programs. To meet the first objective the following specific tasks were undertaken:

- Investigate the program status of approved OrdAlts scheduled for GWSRP equipments and components. Compare the planned versus actual modernization program for restoration.

- Provide technical assistance in development and planning program requirements to implement on-line terminal installation supporting the GWSRP Management Information System (MIS). Provide recommendations concerning the system hardware and operators required at planned sites for optimum interface with the existing data base management system.
- Investigate the waterfront site facilities currently used for the removal and installation of GWSRP equipments and components. Develop the recommended actions and list the material required to ensure that the installation sites have the necessary equipment to perform the removal and installation of GWSRP systems.

To meet the second objective the following specific tasks were undertaken:

- Provide recommendations concerning the refinement of existing CMPs developed by the DDEOC Program. Using the end-of-BOH reports, Maintenance Data System (MDS) data, and other status systems, develop similar system and equipment requirements for inputs to emergent EOC programs.
- Provide engineering analysis to pursue the integration of GWSRP scheduling requirements with the DDEOC Program and emergent EOC programs. Analyze existing GWSRP schedules and scheduling policy, DDEOC Program maintenance schedules and scheduling policy, and emergent EOC program scheduling development. Make recommendations to minimize scheduling difficulties occurring during the overhaul, restoration, and maintenance of GWSs.
- Provide continuing engineering support to the coordination between the GWSRP and EOC programs. Assist in technical and administrative efforts required to effect liaison between GWSRP and EOC program participants.

The following analytical procedures were applied to the aforementioned study tasks:

1. Collect Information. The first step was to collect information concerning the program elements and the specific procedures being followed in each task area. The information consisted mainly of documents in the form of existing procedures, program management plans, instructions, technical manuals, ordnance publications, OrdAlt completion reports, and maintenance requirements. Data were acquired from GWSRP, DDEOC, and Naval ordnance publications and documentation, interview results, and ARINC Research files. Data collection was a continuing process, with the majority of information collected in the early months of the contract.
2. Analyze Information. The collected information was analyzed. The data were systematically reviewed, and opportunities for potential improvements and integration with existing procedures were identified.

3. Develop Tentative Program Improvements. Tentative program improvements in the areas studied were developed. Documented analyses combined with continuous contact with program personnel resulted in the initial findings.

4. Conduct Interviews. Concurrently with Step 3, the responsible principals in the GWSRP program were interviewed to gain further information and insight into the documentation and the subject task areas and to discuss and obtain comments on the preliminary findings.

5. Develop Conclusions and Recommendations. The final step was to develop the conclusions and recommendations based on the analyses.

1.4 REPORT ORGANIZATION

Each of the following chapters deals with a particular task. The conclusions and recommendations resulting from the analysis in a specific task area are stated at the end of each chapter. Thus each chapter is complete in itself and, if necessary, can be distributed separately. Appendixes A through G present data supporting the analyses. Appendix H is a glossary of terms.

CHAPTER TWO

GUN WEAPON SYSTEM MODERNIZATION STATUS

2.1 PURPOSE

One of the objectives of the Class A overhaul of a gun mount at Naval Ordnance Station, Louisville (NOSL) is to bring the equipment up to the latest Fleet configuration by installing all applicable OrdAlts that are currently in effect for that particular type of gun. The Fleet Modernization Program (FMP) provides for the orderly planning, programming, budgeting, and installation of these OrdAlts through the execution of the Ordnance Improvement Plan (OIP). The OIP lists all applicable OrdAlts and Engineering Change Proposals (ECPs) in the order of priority of accomplishment for each particular ship class. It is the concern of the cognizant NAVSEA and Naval Ordnance Station, Indian Head (NOSIH) program managers to ensure that gun mounts entering the GWSRP turnaround program are in fact brought up to date with the current improvements before they are reinstalled aboard ship. Therefore, a review of the record of accomplishment of NOSL in supporting this goal will provide GWSRP managers insight into whether depot level OrdAlts are being installed in a timely manner.

The purpose of this analysis, then, is to provide the cognizant GWSRP managers with a status of the planned versus actual modernization program concerning depot-level OrdAlt installations for selected gun mounts.

2.2 DATA COLLECTION AND APPROACH

The scope of this task was limited to a specific period, fiscal year (FY) 1979; thus the collected data present a representative sampling as opposed to an all-inclusive historical record of past OrdAlt accomplishment at NOSL. The NOSL overhaul schedule was reviewed, and gun mounts undergoing overhaul at NOSL during FY 1979 from six ships of the FF-1052 Class were selected. The OIP for FY 1979 was reviewed, and all OrdAlts applicable to the FF-1052 Class gun mount were identified. These OrdAlts were compared with a Fleet Modernization Program OIP Hull Application Matrix with OrdAlts (dated 10 August 1978) to determine which OrdAlts had already been accomplished or were not applicable to any of the six selected FF-1052 Class ships. The remaining OrdAlts were compared with configuration verification reports that were issued on each selected ship's gun mounts upon release from the overhauling activity (NOSL). These

configuration verification reports provided a status of the OrdAlts that were accomplished by NOSL during the designated gun mount overhaul.

2.3 RESULTS

The results of this analysis are shown in Tables 2-1 and 2-2. Table 2-1 provides the status of all applicable FY 1979 OIP OrdAlts by ship. Table 2-2 summarizes the accomplishment rate of the subject OrdAlts by NOSL. During this study, several OrdAlts were identified that required additional information to determine their accomplishment status. OrdAlt 8857, which was listed in the FY 1979 OIP (and subsequent OIPs), was not included in the configuration verification reports. OrdAlt 7457 was listed in the configuration verification but was not called out in the FY 1979 (or subsequent) OIP. Through conversations with NAVSEACENPAC and NAVSEACENLANT personnel, additional information regarding the status of these two OrdAlts was collected. In addition, completion status for many OrdAlts was not properly displayed on the configuration verification reports; i.e., there was no check mark in any of the applicable status columns. Conversations with configuration control personnel at NOSL revealed that many OrdAlts were not checked, because the OrdAlts themselves were not available for installation at that particular time or NOSL did not work on that particular equipment. EP1 and EP2 panels, as an example, do not leave the ship during overhaul and are accomplished by shipyard or NAVSEACEN personnel. Since the OrdAlt is accomplished by another activity, the information is not entered in the configuration verification document. It was further revealed that NOSL is developing a new configuration verification document that will enable NOSL to track OrdAlt accomplishment more closely during overhaul. New procedures for tracking OrdAlt accomplishment should also be initiated concurrently with the issuance and use of the new configuration verification documents. Those OrdAlts in which accomplishment status was not indicated are included in Table 2-1. If there was a lack of configuration verification status for a particular OrdAlt, it was considered unaccomplished; it is indicated as such in Table 2-1. OrdAlts associated with the gun mounts telescope (OrdAlts 8166 and 6062) lack verification status because they are accomplished by the optical shop at NOSL, which is separate from the gun rework shop. Therefore, information is not usually entered into the configuration verification reports. Conversations with NOSL configuration control personnel indicate that this apparent oversight will be corrected with the implementation of the forthcoming configuration documentation changes. Reasons for lack of configuration verification status for the various OrdAlts are given in the chart legend as appropriate.

To give an accurate picture of actual OrdAlt accomplishment by NOSL, those OrdAlts that were not available for accomplishment during a particular ship's overhaul, or those whose subject equipment was not delivered to NOSL (e.g., EP1, EP2 panel, gun control equipment) were not included in the accomplishment summary of Table 2-2.

Table 2-1. NOSL ORDALT ACCOMPLISHMENT DATA FOR SELECTED SHIPS OF FF-1052 CLASS

FY 1979 OIP OrdAlt Number	FF-1056	FF-1059	FF-1062	FF-1067	FF-1091	FF-1096
7843	AL	*	*	*	*	*
8085	AL	AL	*	*	*	*
8041	AL	*	*	*	*	*
8081	AL	*	*	*	*	*
8483	AL	AL	AL	AL	*	AL
8555	AL	AL	AL	AL	a	AL
8554	*	AL	a	AL	AL	AL
8845 ★	a	AL	a	a	a	a
8507	*	AL	a	AL	AL	AL
8553	AL	AL	AL	AL	AL	AL
8556	AL	AL	a	AL	a	AL
8557	AL	AL	AL	AL	AL	AL
8844 ★	DLU	DLU	DLU	DLU	DLU	DLU
7828	AL	*	*	*	*	*
8244	AL	*	*	*	*	*
8107-2	AL	*	*	*	*	AL
8873	AL	AL	AL	AL	AL	AL
8861	AL	AL	AL	AL	AL	AL
8723 ★	a	AL	a	a	a	a
9103	*	*	a	*	AL	AL
8099	AL	*	*	*	*	*
8394	AL	*	AL	*	*	*
8538	*	*	AL	*	AL	AL
8420	*	*	AL	*	AL	AL
8879	*	AL	AL	*	AL	AL
8101	AL	*	*	*	*	AL
7651	AL	*	*	*	*	*
7566	AL	*	*	*	*	*
8071	AL	*	*	*	*	AL
8082	AL	*	*	*	*	*
8098	AL	*	*	*	N	N
8293	AL	*	*	*	*	*
8166 ●	DLU	DLU	AL	AL	DLU	AL
8046 $	a	a	*	a	a	a
9508	a ★ ● ●	AL	a ● ●	AL	a ● ●	AL
8087	AL	*	*	*	*	*
8961 ★★	a	AL	a	a	a	a
9159 ★★	a	AL	AL	AL	a	a
7844	*	*	*	*	*	AL
6062 ●	a	a	AL	*	N	*
8724 ★	a	a	a	a	a	a
7846 $	DLU	*	DLU	DLU	DLU	DLU
9064 $	a	a	a	a	a	a
8992 $	a	a	a	a	a	a
7857 $	DLU	DLU	DLU	DLU	DLU	DLU
7457 $	a	a	*	*	a	a
8880 ★	a	a	a	a	a	a
9056 ★	a	a	a	a	a	a
8857 ● ●	a	a	a	a	a	a

KEY

AL - OrdAlts accomplished during last overhaul at NOSL.
* - OrdAlts accomplished previous to last overhaul at NOSL.
a - Applicable unaccomplished OrdAlts.
N - Not applicable.
DLU - Unaccomplished depot-level OrdAlts.
★ - OrdAlt not released in time for accomplishment on subject ship, no verification status given.
★★ - FY 1980 OrdAlt, not released in time for accomplishment on subject ship, no verification status given.
● - Mk 116 telescope related OrdAlt, no verification status given.
$ - Equipment not delivered to NOSL (EP1, EP2 panel/gun control equipment), no verification status given.
● ● - Subject OrdAlt not listed in configuration verification reports.

Table 2-2. SUMMARY OF NOSL ORDALT ACCOMPLISHMENT ON SELECTED SHIPS OF FF-1052 CLASS

FY 1979 OIP OrdAlts	FF-1056	FF-1059	FF-1062	FF-1067	FF-1091	FF-1096
OrdAlts Accomplished Last Louisville Overhaul	24	16	13	12	10	19
Total Unaccomplished OrdAlts*	1	1	6	1	4	1
Percent OrdAlts Accomplished	96%	94%	68%	92%	71%	95%
*Unaccomplished OrdAlts	8857	8857	8554 8507 8556 9103 9508 8857	8857	8555 8556 9508 8857	8857

2.4 CONCLUSIONS AND RECOMMENDATIONS REGARDING GUN WEAPON SYSTEM MODERNIZATION STATUS

From the review of the record of accomplishment of FY 1979 OIP Mk 42 Mod 9 gun mount OrdAlts at NOSL, a complete status of the applicable OrdAlts was prepared. Conclusions and recommendations regarding the findings of this review are presented in the following subsections.

2.4.1 Conclusions

The following conclusions resulted from the review:

- NOSL is accomplishing a great majority of the budgeted OrdAlts concerning Mk 42 Mod 9 gun mounts. The percentage of OrdAlt accomplishment displayed in Table 2-2 show a favorable record of performance for most of the ships surveyed.
- The present means of tracking OrdAlts should be improved. There were many instances in which configuration verification could not be determined from the data available. Much of the confusion stems from the fact that many OrdAlts during an overhaul or availability period are accomplished by activities other than NOSL (e.g., NAVSEACENS, shipyards), and verification of accomplishment is not always received by configuration control personnel at NOSL. This problem is also evident within NOSL itself -- OrdAlts performed in the optical shop facility at NOSL are not always entered into the configuration verification reports. Conversations with configuration control personnel at NOSL indicate that the overall tracking of OrdAlt accomplishment will be improved with the issuance of a new configuration verification report.

- Conflicting information between OIPs prepared by the Weapons Quality Evaluation Center (WQEC), Concord and configuration verification reports prepared by NOSL point out a need for greater coordination between NOSL and WQEC to ensure that OrdAlt data are properly used and accounted for. An example of this problem is OrdAlt 8857, which is listed in the FY 1979 (and subsequent) OIPs but is not listed in the configuration reports.

2.4.2 Recommendations

On the basis of the review's conclusions, the following recommendations are offered:

- New procedures for OrdAlt verification should be implemented with the pending issuance of the revised configuration verification reports. Positive control of OrdAlt accomplishment should be initiated, with a means for providing OrdAlt accomplishment data to configuration control personnel regardless of where the OrdAlt is actually performed.
- Coordination of OIPs and configuration verification reports should be improved to eliminate contradictions and data omissions. Communication channels between WQEC, NOSL, and other interested parties should be maintained so that accurate and up-to-date information can be made available to the cognizant Fleet Modernization Program (FMP) managers.

CHAPTER THREE

AUTOMATION OF GWSRP MIS DATA EXCHANGE

3.1 DESCRIPTION OF CURRENT MIS

The GWSRP MIS provides various reports using all data submitted by the Material Condition Review (MCR) team (supported by data from other Ordnance and Hull data files); these reports are used to evaluate gun weapon systems that require overhaul or replacement. In addition, these MIS reports are used by all participants to identify and establish priorities for overhaul candidates, determine additional inspection requirements, and monitor GWSRP operations. A description of each report is given in an earlier study conducted by ARINC Research for NOSIH, *A Continuation of the Gun Weapon System Replacement Program Coordination Effort Study*, ARINC Research Publication 1661-01-1-2010, September 1979.

The MIS is directed by NAVORDSTA, Indian Head (NOSIH), acting as NAVSEA agent, as part of the Material Condition Review Program. NOSIH contracts with NAVWPNSTA Concord (WQEC-384) to provide the necessary data processing services, interfacing with the Ships Header File, 3-M and Ordnance Master files, and other data files as required.

The MCR is the principal source of data for the GWSRP MIS. Information collected in the performance of the MCR is entered into a computer file for future use in formulating management reports and historical data files. The MCR is coordinated by the GWSRP managers in the Naval Systems Command. It is a formal inspection to determine the actual material condition of ordnance equipment so that the equipment can be replaced or its useful life can be extended by unit or subunit replacement. The MCR is conducted by the respective Naval Sea Support Centers (NAVSEACENs) for the Atlantic and Pacific Fleets. The results of the MCR are currently distributed by having the NAVSEACENs submit summary reports to the appropriate Type Commander (TYCOM) and to the Gun Systems Engineering Division, NOSIH. This information is reviewed and edited by NOSIH and then mailed to WQEC, Concord, where it is entered into the computer data bank.

3.2 ANALYSIS APPROACH

There is a consensus among the key GWSRP managers at NAVSEA and NOSIH, as well as computer processing personnel at WQEC, that the present manual means of MCR data transfer is both time-consuming and prone to human errors

and omissions. Automation of the data transfer procedures has been proposed as a means of solving these problems. It is believed that the use of on-line computer terminals to aid in the MCR data exchange would greatly enhance real-time response, eliminate keypunch requirements, minimize data transmission errors, and in general provide for a more efficient MIS. The purpose of this analysis is to develop the program requirements for installation of computer terminals at key activities for input and retrieval of data that are relevant to the effective management of the GWSRP MIS. During the data collection phase of this analysis, the present data exchange procedures and activity responsibilities were investigated and documented. A proposed automated means of data exchange was applied to the present data transfer system, with the present activities' capabilities taken into consideration. In addition, present and future Navy-wide computer applications for data transfer were also reviewed to ensure that any GWSRP computer system that might be installed would be compatible with the Navy-wide procurement policy of computerized MIS. The following sections present the results of this analysis.

3.3 ANALYSIS OF EXISTING MIS SYSTEM CONCERNING GWSRP

Initially in this analysis, all the key activities were studied with regard to their respective contributions to the formulation, review, exchange, and processing of GWSRP MIS data. The responsibilities for each activity are as follows:

Naval Sea Support Center

1. Coordinate TYCOM-established MCR schedule of all ships before Regular Overhaul (ROH) to determine the replacement requirements.
2. Perform on-board MCR, logging condition of all equipment and summarizing all findings.
3. Inform Ship Weapons Officer of MCR and itemize necessary repairs or adjustments that are to be accomplished by the Ship's Force.
4. Report accomplishment of MCR to TYCOM and NOSIH, using MCR Summary Sheets.
5. Maintain files on all completed MCRs as reference for further justifications.
6. Recommend level of maintenance that is necessary to effect the replacements or repairs identified during the MCR (Ship's Force, IMA activities, and shipyard). This specified level of maintenance is called the Material Condition Level (MCL).

Naval Ordnance Station, Indian Head

1. Material Condition Review Program
   a. General Program Management
      (1) Provide guidance for the operation, policy, and procedures used for the MCR Program.

(2) Update, revise, and develop MCR manuals for use by NAVSEACENs.

b. NAVSEACEN Interface and Monitor

(1) Scheduling MCRs

(2) Implementing MCRs

(3) Reporting accomplishment of MCRs

c. Recording and Maintenance of MCR Documentation

(1) Ship's cumulative log

(2) MCR summary reports by ship and equipment

(3) MIS data and outputs

(4) GWSRP schedules

d. Review and Distribution of MCR Summary Reports

(1) Verify data (completeness)

(2) Compare data with MIS data

(3) Note discrepancies and verify

(4) Mail copies to Concord

e. Analysis of MCR Summary Reports

(1) Determine system overhaul requirements

(2) Determine component overhaul requirements

(3) Compare results with other Navy inspection reports and reporting system data

(4) Perform economics analysis of repairs and replacements

(5) Compile the documentation identified to justify the overhaul requirements

(6) Establish the Equipment Replacement Code (ERC) for each system in accordance with the MCR instruction

2. Management Information System

a. Provide necessary data and management support to WQEC, Concord to maintain, program, and distribute applicable reports to GWSRP participants

b. Provide GWSRP Management Reports

- Fleet Report on Gun Systems (FROGS) (Annual)
- Fleet Report on Gun Systems (FROGS) (Quarterly)
- Equipment Condition Report (ECR)
- Material Condition Review (MCR) Status Report
- Overhaul Replacement List (ORL)

- Year-End Report
- Equipment Installation Summary
- Delinquent MCR status
- System Replacement Summary
- System and Component Replacement

NWS Concord (WQEC Code 384) - Manages the programming, compiling, file update, and information outputs of the GWSRP MIS. This involves:

1. Inputting MCR results
2. Integrating data with existing data file
   a. Ship's header file - contains ROH dates, home port, and general information data
   b. Ship's Equipment Configuration Accounting System (SECAS) data

Documentation of the step-by-step events that lead to actual data processing constituted an important part of the data collection process. The data processing steps involved in the preparation of an MCR report are summarized as follows:

- NAVSEACEN Inspection Team
  - Inspect GWSRP equipment and enter results into MCR booklets and summary sheets
  - Assign MCL values to components
  - Provide narrative describing necessary repairs in accordance with MCR instructions
  - Deliver completed MCR booklets and summary sheets to parent NAVSEACEN
- NAVSEACEN
  - Receive and review MCR booklet and summary sheets
  - File booklets
  - Forward summary sheets with cover letter to NOSIH
- NOSIH
  - Receive summary sheets
  - Edit and analyze summary sheet data
  - Assign ERC to equipment
  - Forward summary sheets with an attached analysis sheet to WQEC

- WQEC
  - •• Receive summary sheets (with analysis sheets)
  - •• Keypunch summary sheet information onto cards
  - •• Perform an edit operation on the data
  - •• Input information into computer
  - •• Run programs for standard GWSRP reports as required

Currently, MCRs are conducted by the NAVSEACENs at a rate of approximately 15 inspections per calendar quarter by each fleet (Atlantic and Pacific), resulting in a total of 30 reports per quarter that are received by NOSIH. Each distinct GWS has a unique summary sheet listing the components contained in that particular system. The length of these summary reports varies according to the type of system being inspected (some systems have more components on check than others) and the material condition of the system as indicated on summary sheet No. 1 (explanatory remarks must be made on summary sheet No. 2 for any components with an MCL designation of 2, 3, or 4). Summary sheet No. 1 also contains areas to list Federal Stock Numbers (FSNs) and Allowance Parts List (APL) numbers for any component requiring replacement. Samples of the MCR summary report sheets are presented in Appendix A, together with a description of the different Material Condition Levels and a sample of the MCR analysis sheet, which is prepared by NOSIH upon review of the submitted MCR summary report sheets.

In the review of procedures for MCR documentation, discussions were held with key GWSRP personnel at NOSIH and WQEC to obtain estimates of the time it takes all participating activities to process a typical MCR report. Historical data during the period September 1979 to May 1980 were reviewed; the results of this review showed that it takes an average of 65 days from the time an inspection is completed for an MCR report to arrive at WQEC Concord. Usually another five to seven days can be added for processing time at WQEC before the summary sheet reports are actually entered into the data base.

The MCR information flow for the input of MCR data via the GWSRP MIS is shown in Figure 3-1. Upon completion of an MCR inspection by the NAVSEACEN, the results are summarized on two MCR summary report sheets contained in each inspection manual. The ship is informed of all noted discrepancies before the team's departure, and the ship's weapon officer is advised that all discrepancies noted on Summary Sheet No. 2 should be reported within the 3-M system by using the OPNAV 4790/2K forms. Summary Sheets 1 and 2 are forwarded (by mail) to the appropriate TYCOM and to the Gun Weapon Systems Engineering Division, NOS, Indian Head. The NAVSEACEN retains all other MCR data sheets on file.

NOSIH receives the MCR summary sheets from NAVSEACENPAC/LANT, reviews and edits them, and distributes them to NAVSEA 62 YGB, WQEC Concord, and NAVORSTA Louisville. NWS Concord (WQEC Code 384) receives the summary sheets from NOSIH and inputs the MCR results into the data base as depicted in Figure 3-2. Information output in the form of various GWSRP reports is then disseminated to the GWSRP managers.

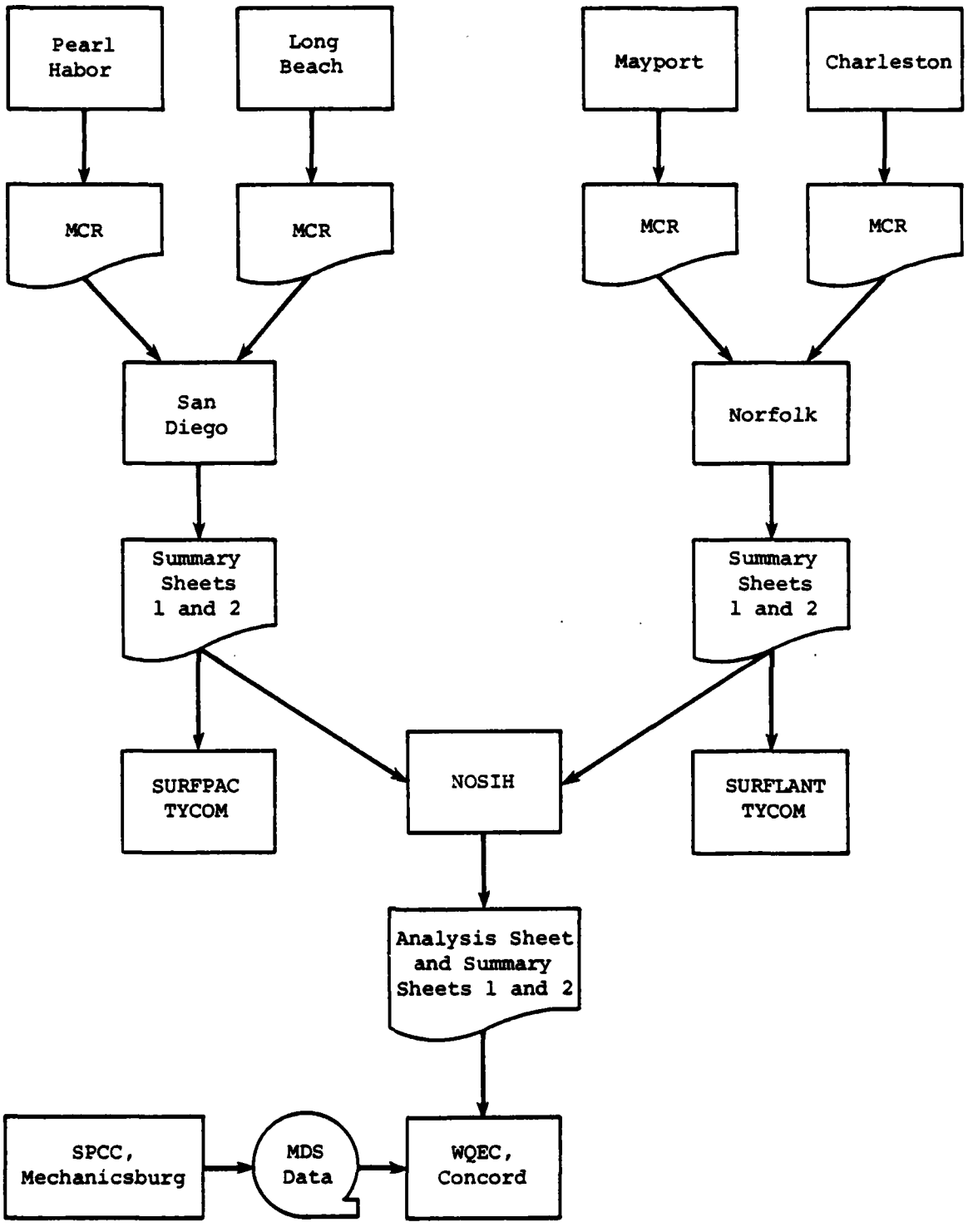


Figure 3-1. CURRENT GWSRP MIS DATA INPUT FLOW

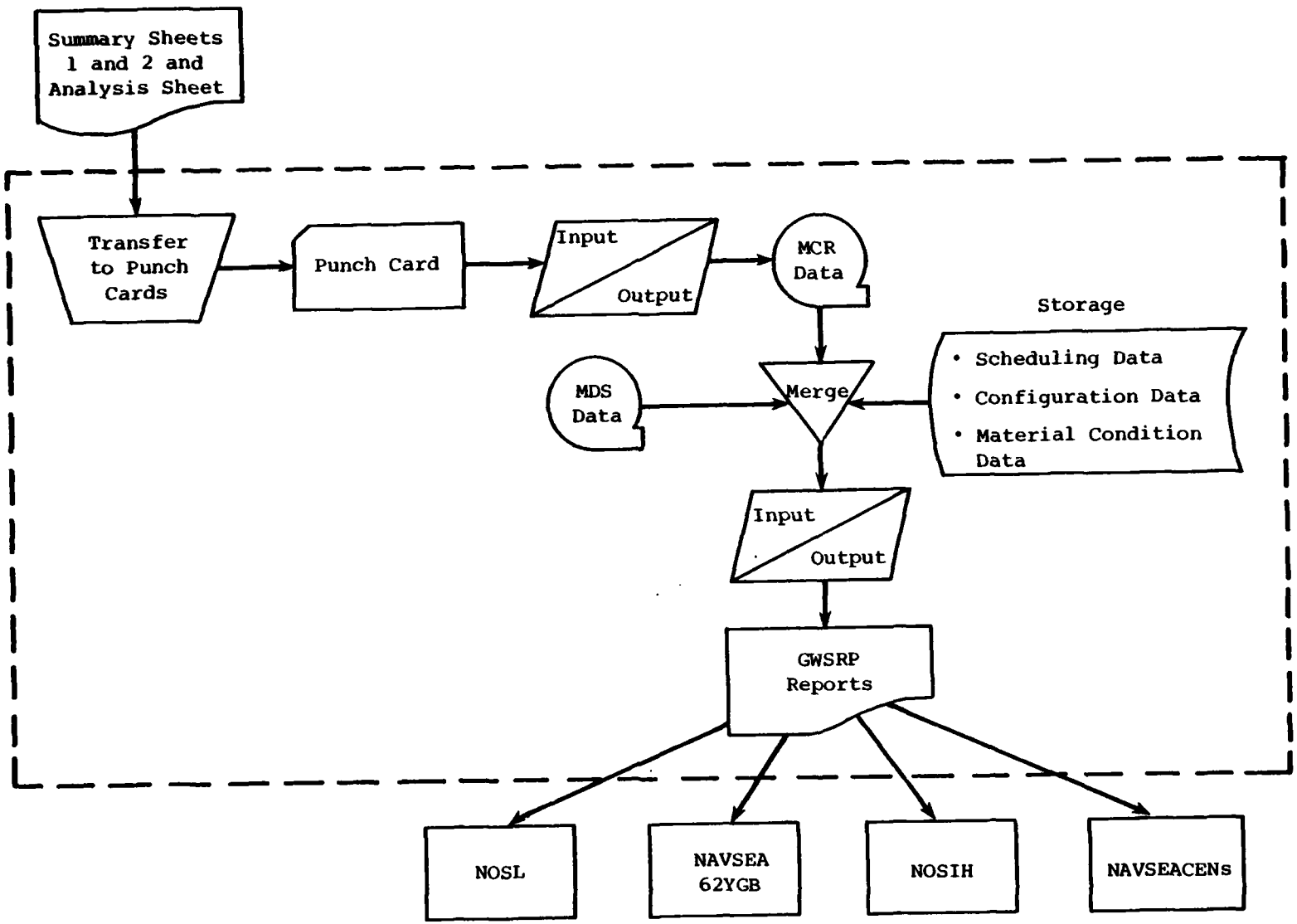


Figure 3-2. GWSRP MIS DATA FLOW AT WQEC, CONCORD

A current problem with the existing manual system of data transfer is that it is unresponsive to errors contained in the submitted MCR summary sheets. There have been numerous instances in which various components have undergone an inspection and the serial numbers were omitted. These kinds of errors are impossible to correct because of the amount of time between a completion of an inspection and the review of the summary sheets at NOSIH. By that time the inspection team has long since been dispersed. Thus an important element of quality control of the MCR summary sheets -- timely correction of errors and omissions -- is lacking because of the mailing procedures inherent in the present data transfer system. In addition, because of the slow process of data transfer, reports that are prepared at WQEC can contain outdated information. This problem results from both the slowness of the present manual system of data transfer and the two-week deadline under which WQEC operates (all data must be present in the computer two weeks before the end of the current calendar quarter). NOSIH must therefore mail the current MCR summary sheets to WQEC the first week of the last month of the quarter for the information to be received by the deadline. Thus, information contained in any quarterly GWSRP report is typically truncated by approximately one month.

3.4 DEVELOPMENT OF THE AUTOMATED SYSTEM RATIONALE

The current system as described in Section 3.3 was analyzed to determine what the new system must accomplish. Constraints that were essential to the acceptance of a new system were also identified. This initial fact-gathering indicated the following:

- The new system must provide the same outputs as the current system.
- The system should be automated wherever possible.
- The MCR summary sheet format cannot be changed.
- The system selected must have, or be compatible with, printing hardware so that proper records and control can be maintained.

On the basis of these criteria, the following system-configuration requirements were established:

- Central Processing Unit (CPU) -- Printer and Tape Reader
- Input keyboard terminal for each NAVSEACEN and NOSIH
- Off-line printer for each facility

Once the existing MIS operation and the needed hardware to effect automation of data transfer was identified, a proposed automated operational procedure was developed and each facility's present capabilities to support the new system was investigated. The following sections describe the proposed automated system procedures and the various computer hardware configurations that are or will soon be available to the GWSRP activities.

3.4.1 Automated System Procedures

In the automated data transfer system, NOSIH will still serve as the focal point of the GWSRP MIS. When an MCR inspection is conducted, the results will be transmitted via a programmable terminal from the NAVSEACEN to NOSIH, where a hardcopy can be obtained from a high-speed printer. The MCR results will be reviewed at NOSIH and processed into a disk/diskette medium for entry into the data base at WQEC, Concord. The system also provides managers with timely access to data to answer specific questions. Maintenance Data System (MDS) information will be transferred from SPCC to Concord by the same procedures used currently. The information flow is shown in Figure 3-3.

If an inspection is accomplished at a NAVSEACEN field activity site, the summary sheets can be telecopied to the parent NAVSEACEN upon completion of the inspection. The other MCRs will be delivered in accordance with current procedures. Upon receipt of the telecopied data at the NAVSEACEN, the summary sheets will then be reviewed and inputted into a programmable terminal for transmittal to NOSIH.

It is expected that the terminals at the respective NAVSEACENs will be capable of providing a tutorial type of input program for the person who is supplying the information. This program will address the data format of the MCR summary report in a step-by-step procedure for data entry. An editing feature will be inherent in this procedure so that mistakes and omissions can be corrected on-the-spot. Data from the NAVSEACENs will be collected by means of a telephone call from NOSIH to the respective NAVSECENs. Data can be transmitted every two weeks via telecommunications and stored on disks/diskettes at NOSIH. After review and editing by the NOSIH GWSRP managers, the MCR data will be reprocessed into a disk/diskette medium for transmittal to WQEC.

The present MIS is partially computerized, with all data processing performed at WQEC, Concord. Transmitting the MCR summary sheet data to WQEC in a disk/diskette medium can essentially eliminate the iterative data processing steps of transforming raw MCR summary sheets to a tape input medium at WQEC (see Figure 3-2). Initial transmission of data from NOSIH to WQEC can be accomplished by mailing the disks/diskettes to Concord. After the new automated system has been tested, operated, and completely debugged, the more expensive means of telecommunications from NOSIH to WQEC can be effected, thereby cutting processing time even further. It is expected that total processing time (from completion of MCR to updating the data base) can be reduced to less than 20 days initially. Once the telecommunications are used between NOSIH and WQEC, total processing time will be approximately two weeks. Thus improvement in terms of time, manhours expended, and accuracy of data transfer can be gained by using programmable terminals at the facilities responsible for the conduct of the MCR inspection and the transmission of the inspection results.

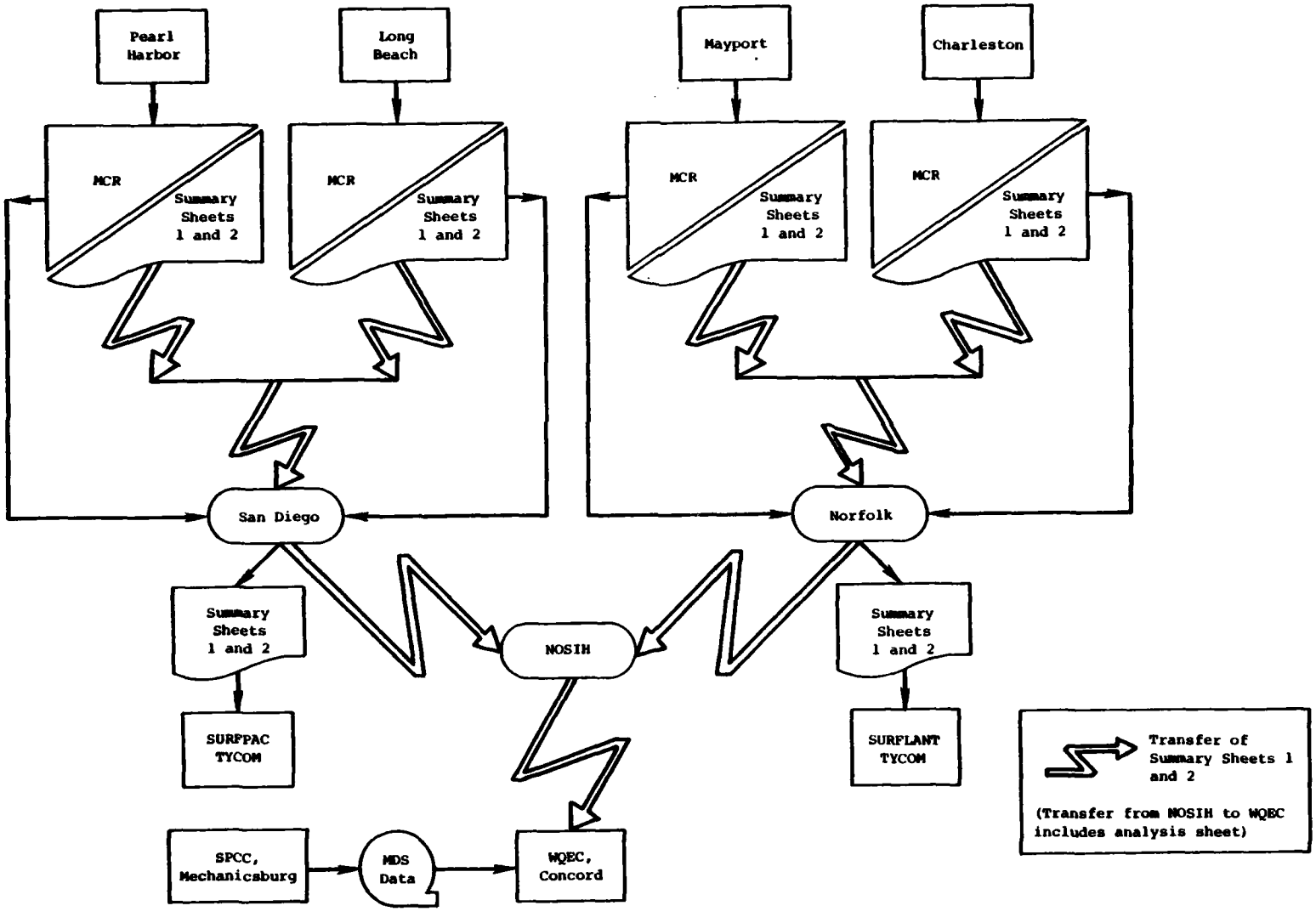


Figure 3-3. PROPOSED AUTOMATED GWSRP DATA FLOW

3.4.2 Present Facility Hardware Capabilities

Computer capabilities at GWSRP facilities were investigated to determine if the proposed automated MIS could be supported by existing hardware. The use of existing hardware was viewed as a viable and much more economical alternative to the purchase of a dedicated system for the GWSRP MIS. Visits were made to the Naval Ship Engineering Command, Norfolk Division (NAVSEC NORDIV), NAVSEACENLANT, Norfolk, Virginia, NAVSEACENPAC, San Diego, California, and WQEC, Concord, California, to determine what systems were available and whether it would be feasible to use these systems for the transmittal of MCR summary sheets.

There currently exists both at NAVSEACENPAC and at NAVSEC NORDIV a computerized method of data transfer that NAVSEACENLANT could use. The Wang 2200 series system is used at both facilities to transmit data for the SECAS Program. The Wang 2200 is configured with a binary synchronous telecommunications package. Enclosed in the package are four emulators:

- IBM 2780 and 3780 Emulation
- IBM 3741 Emulation
- HASP Multileaving Emulation
- 2200 to 2200 communications

This package is combined to allow any user to configure the package to fit his unique communication requirements. Thus this system can communicate not only with similar Wang systems, but also with the typical IBM system or any other system that employs the same IBM or HASP Multileaving Emulation. The Wang system in Norfolk is physically located at NAVSEC NORDIV, which is separate from NAVSEACENLANT Headquarters. An identical system on the West Coast is located in a building adjacent to where the NAVSEACENPAC GWSRP managers reside. Discussions with cognizant personnel at both computer installations reveal that it is feasible to use the existing equipment for transmission of MCR summary sheets. Details of personnel manning, funding, and computer time allocation should be worked out by the cognizant program managers. In addition, GWSRP and SECAS program managers should authorize the direct liaison between the support activities of their respective management information systems to initiate procedures to ensure that the GWSRP MIS data transfer requirements are properly integrated into the existing system. This would require computer programming personnel from both activities to work closely with each other in formulating programs that are compatible with the Wang 2200 and meet the needs of the GWSRP MIS.

Once the data are inputted into the Wang computers at the NAVSEACEN level, NOSIH can initiate data retrieval via telecommunications by polling each respective NAVSEACEN as to how many inspections are currently in the system. NOSIH uses a DATA 100 system, which transmits supply-type information to and receives it from McAllister Naval Ammunition Depot in Oklahoma. This system is compatible with IBM 2780 emulation and with little modification could be used to extract data from the NAVSEACENs. It is located in

the same building as Code 5033, and discussions with cognizant personnel at NOSIH indicate that it could be made available to accommodate the GWSRP MIS data transfer. The modification needed for the present system at NOSIH entails the addition of a peripheral disk/diskette storage device. This storage device can be leased monthly for a total cost of $89 per month for a diskette type or up to $310 per month for disk type storage (including maintenance costs). The disk/diskette medium is much more desirable than the present magnetic tape storage because it can be used to provide low-cost and low-capacity on-line storage for the GWSRP MIS, which does not require a large amount of data storage at the NOSIH level.

WQEC, Concord, currently uses a Honeywell 2200 series CPU for the batch processing of MCR reports and the generation of the various GWSRP reports. Computer time is shared with other organizations on base, and a priority system is established for use of the computer. Discussions with personnel at WQEC revealed that they are considering the possibility of using a PDP-1144 series CPU, which will be installed next fiscal year to support the FFG-7 Class logistics data system. The PDP computer could be configured to accept the diskettes transmitted from NOSIH if hardware peripherals were acquired to handle the communication interface. Thus an automated MIS can be constructed by using existing and budgeted hardware.

Because of the small data demands of the present GWSRP MIS, it is not considered prudent to buy a totally dedicated system at this time. Present requirements dictate the need to transmit 15 MCR reports per fleet each quarter. It is estimated that each MCR summary sheet would contain approximately 4,600 (4.6K) characters for each data transmission. A review of the past fiscal year's performance history shows that MCR inspections are conducted on approximately 120 to 150 equipments each fiscal year. This breaks down roughly to an average of 34 inspections per quarter (17 inspections per quarter for each coast), or about one inspection every three to four working days for each coast. Frequent tranmissions of data are not necessary or advisable, because it would not be economical to transmit data after every inspection. As previously discussed, NOSIH would control the frequency of data exchange by polling the NAVSEACENs regarding how many inspections are available and then transmit multiple inspection reports at one time. Given a minimum of 150 equipment inspections per year, the annual storage requirement would only be approximately 690K characters. A disk/diskette storage system could adequately meet this storage requirement. Additional diskettes would have to be purchased each year if data were retained for historical analysis. However, a larger disk pack unit would be capable of storage in the range of 2 million to 200 million characters.

The relatively small amount of storage needed and the small amount of data flow via telecommunications does not warrant a dedicated automated system at this time. In the future, with the additional need for MCR inspections of new gun weapon systems (Mk 45, Mk 75 gun mount; Mk 86, Mk 92 gun fire control systems; and Close-In-Weapon Systems), a dedicated system might be desirable and feasible.

A review of the present plans for installation of these new systems was conducted to determine the impact they would have on the present MCR inspection schedule. Table 3-1 displays fleet allocations (active and

Table 3-1. FLEET ALLOCATIONS OF SURFACE WARFARE GUN FIRE CONTROL SYSTEMS

Status	System Type	Number Allocated by Fiscal Year								
		1980	1981	1982	1983	1984	1985	1986	1987	1988
Active	Mk 37	0	0	0	0	0	0	0	0	0
Training		19	5	5	0	0	0	0	0	0
School/Station/Yards		11	11	11	0	0	0	0	0	0
Total		30	16	16	0	0	0	0	0	0
Active	Mk 56	34	34	34	34	34	34	32	28	24
Training		3	1	1	1	1	1	1	1	1
School/Station/Yards		9	9	9	9	9	9	9	9	9
Coast Guard		15	15	15	15	15	15	15	15	15
Total		61	59	59	59	59	59	57	53	49
Active Training	Mk 68	106	106	106	106	106	106	104	100	96
Training		1	1	1	1	1	1	1	1	1
School/Station/Yards		11	11	11	11	11	11	11	11	11
Map		13	13	13	13	13	13	13	13	13
Total		131	131	131	131	131	131	129	125	121
Active	Mk 86	40	44	45	47	48	49	53	56	58
Training		0	0	0	0	0	0	0	0	0
School/Station/Yards		4	4	4	4	4	4	4	4	4
Total		44	48	49	51	52	53	57	60	62
Active	Mk 92	9	19	29	39	46	50	54	57	61
School/Station/Yards		1	1	2	2	2	2	2	2	2
Coast Guard		2	4	7	10	13	13	13	13	13
Total		12	24	38	51	61	65	69	72	76
Active	CIWS	19	63	124	196	272	351	383	383	383
School/Station/Yards		4	4	4	4	4	4	4	4	4
Total		23	67	128	200	276	355	387	387	387

Source Document: Projected force levels - ships and aircraft supplemental tables of 7 January 1980.

training platforms) of Surface Warfare Gun Weapon Systems from FY 1980 through FY 1988. Gun Mount totals are shown in Table 3-2. It can be readily seen that the addition of these new systems will strain the existing MCR program resources. By FY 1988 (taking into account attrition of old systems and addition of new ones) the numbers of systems requiring MCR inspections will have grown to a total of 1,216 -- an increase of 401 systems (or 50 percent) over the present 815. From the figures in Table 3-1 it can be seen that by FY 1985 the number of equipments will be more or less stabilized through FY 1988 (attrition will more or less equal additions). In FY 1985 it is estimated that approximately 223 inspections will have to be conducted if the MCR inspection rate is to keep pace with the present requirement of conducting inspections on a particular equipment every three years. This represents an increase of 73 inspections per year (or 49 percent) from the present estimation of 150 inspections per year. With this anticipated workload it seems justifiable to automate the GWSRP MIS in the very near future. Through a phased approach -- i.e.,

Table 3-2. FLEET ALLOCATIONS OF GUN MOUNTS

Mount Type	Number Allocated by Fiscal Year								
	1980	1981	1982	1983	1984	1985	1986	1987	1988
3-Inch/50	172	172	172	172	172	170	161	153	145
5-Inch/38	74	43	43	42	42	42	42	42	42
5-Inch/54 Mk 42	172	172	172	172	172	172	167	159	148
5-Inch/54 Mk 45	84	91	93	97	99	101	109	115	119
76MM Mk 75	11	23	36	49	59	63	67	70	74

Note:

Mk 92, CIWS GFCS, and Mk 75 gun mount data are in accordance with present planning, subject to change before actual installation.

using existing hardware at first and then evaluating the feasibility of a dedicated system -- the costs and risks of automation will be held to a minimum.

3.4.3 Program Requirements for an Automated MIS

Program requirements for facilitating implementation of this automated data transfer system for the GWSRP MIS should take into account system hardware specifications, software development and management, personnel billets needed, and the actual physical site of the hardware. Hardware specifications were set forth at the beginning of Section 3.4. These hardware and physical site requirements can be met as described in Subsection 3.4.2 by using existing systems at the various facilities.

Software development and management consists of four phases: Specification, Design, Production, and Computer Program Integration and Testing. In these processes it is important to note that software programs developed for the GWSRP MIS will be required to interface with an already existing system. Therefore, the software needs of the GWSRP MIS should be compared with the existing software packages to identify the various operating procedures and systems standard with which integration must be achieved. Appendix B presents the requirements that must be considered for software development and management. The need for additional personnel billets to operate the automated GWSRP MIS is not foreseen at this time. By using the existing operating systems, the GWSRP MIS should be able to function with a minimal impact on personnel. Software programs for the transmission of data should be tutorial and of a higher-level language so that present personnel at the NAVSEACENs and NOSIH will be able to input and retrieve data on their own. However, a temporary steering committee should be formed during the

development and implementation stages of the system conversion effort. These may require additional expertise to manage the integration efforts at all levels of the GWSRP MIS. Computer vendors and consultants may be of assistance in both the development of software and the implementation of the automated GWSRP MIS.

3.5 NAVY-WIDE COMPUTER ACQUISITION PROGRAMS

In an effort to coordinate any future hardware procurements supporting the GWSRP MIS with Navy-wide hardware procurement policy, an investigation was conducted into the Navy's Shipboard Nontactical ADP Program (SNAP). Initially, this report's findings centered mainly on the compatibility of any proposed GWSRP MIS hardware with the proposed system being procured under the SNAP. However, as previously discussed, it seems feasible and economically prudent to automate the GWSRP MIS with existing systems instead of procuring equipment that would be compatible with SNAP. In the future, as the GWSRP MCR reporting requirements become more complex and frequent because of the new systems being inducted into the program, a dedicated system employing the SNAP technology could be used. A brief historical sketch of SNAP is presented below to make the cognizant GWSRP managers aware of the new direction that the Navy is taking in automating their various reporting systems.

SNAP has been initiated to upgrade nontactical ADP systems in the Fleet. The current system, the AN/UYK-5, is being replaced. The AN/UYK-5 is more than 12 years old and represents second-generation technology; it also has a low mean time between failures (MTBF). In addition, spare parts are scarce, the computer system is out of production, and the current demand exceeds the system's capacity. Workload on the system will increase through the addition of four programs:

- Pay and personnel administrative support system (PASS)
- Composite operational reporting system (CORS)
- Visibility and management of support costs (VAMOSC)
- Naval aviation logistics command management information system (NALCOMIS)

The combined effect of all these factors makes it imperative to replace the AN/UYK-5 system. As currently conceived, the replacement program has three elements: SNAP I Phase 1, SNAP I Phase 2, and SNAP II. SNAP I Phase 1 encompasses the procurement of computer line printers to replace the RD-302 printer, and magnetic tape subsystems for use on the RD-270(V)/UYK transport. Two contracts have been awarded: one to HETRA Computers and Communications, Inc. of Melbourne, Florida, for the production of 100 computer line printers; and one to MILTOPE Corporation of Plainview, New York, for the production of 100 magnetic tape subsystems. (A magnetic tape subsystem consists of four tape drives and one tape controller.) These contracts do not include any warranty provisions. Equipment installation was

scheduled to begin in March 1979. Candidate installation sites include tenders, aircraft carriers, Marine Corps Air Groups (MAGs), repair ships, amphibious assault ships, combat stores ships, and Naval and Marine Air Stations.

SNAP I Phase 2 encompasses the procurement of CPU peripherals (not covered under Phase 1) and executive-level operating system software. Procurement documentation for Phase 2 is currently in preparation.

SNAP II encompasses the procurement of intelligent terminals on small nonautomated ships. This program was conditionally approved at the Navy Acquisition Review Council (ARC) in February 1978. Final program approval is pending the approval of testing, training, and support documentation.

The SNAP II Program provides selected baseline capability, both in software and hardware, which can be expanded sufficiently under subsequent programs, to satisfy foreseeable requirements in nontactical automatic data processing. Present system procurement philosophy for SNAP II favors the utilization of off-the-shelf ruggedized commercial equipment. This hardware, when installed, will provide a means by which data can be transferred from the ship to shore activities for data processing and analysis. The GWSRP MIS could benefit from this program by having shipboard MCR inspectors input their data directly into an automated system the same day as the inspection. This would greatly increase response time and quality control of the raw data input. The benefits to be gained by the utilization of on-board data terminals dictate that the GWSRP managers closely monitor the progress of SNAP. Any decision to procure a dedicated system in the future should take into account the possible utilization of the SNAP II shipboard facilities, which would greatly facilitate GWSRP MIS data transfer operations.

3.6 CONCLUSIONS AND RECOMMENDATIONS

From the conclusions drawn from the analysis of automating the GWSRP MIS data exchange, we have developed recommended methods and requirements for implementing a computerized data exchange system. Cooperative action by both GWSRP and SECAS program management will be necessary in the development and implementation of an automated GWSRP MIS data exchange.

3.6.1 Conclusions

The following conclusions were reached as a result of the analysis:

- The present GWSRP MIS data exchange procedures are time-consuming and lack a sufficient degree of quality control over the input of data into the system.
- Automation of the GWSRP MIS data exchange through the use of existing computer hardware is feasible. Coordination between cognizant program managers is mandatory for the utilization of the computer facilities and the integration of required software programs.

- The present volume and rate of data exchange in the GWSRP MIS do not warrant the purchase of a dedicated automated data transfer system at this time. The use of existing computer hardware will result in the quickest, most cost-effective means of achieving an automated GWSRP MIS.
- Program requirements for computer hardware can be met by using present equipment located at the concerned activities. Development and implementation of the automated GWSRP MIS will require additional personnel to head the conversion project steering committee and additional funds for the development and management of software and the procurement of needed communication interface and storage peripherals.
- Utilization of shipboard computer hardware provided under the envisioned Navy-wide implementation of SNAP II can potentially benefit the GWSRP MIS. On-the-spot transmission of MCR data from inspection teams to their respective NAVSEACENs would reduce data processing time, reduce transmission errors, and enhance real-time response.

3.6.2 Recommendations

The following recommendations are offered:

- Efforts to automate the GWSRP MIS data exchange should be initiated in a phase approach. MCR data should be telecopied to the NAVSEACENs from the various field activities. Automation of the data exchange at the NAVSEACEN and NOSIH levels should be implemented through the use of existing computer hardware available at each respective facility. The use of telecommunications for data transmission from NOSIH to WQEC should not be implemented until the newly automated MIS system has been debugged and is operating reliably.
- Cognizant GWSRP managers and SECAS personnel (who currently control and operate the computer hardware) should jointly integrate the GWSRP MIS program requirements into the existing system. The development and management of the GWSRP MIS software packages and data transmission requirements should be conducted with the operating constraints and procedures of the present system in mind.
- The GWSRP MIS manager should appoint a project steering committee to oversee the development and implementation of automated GWSRP MIS procedures, and to conduct a cost-feasibility analysis of the proposed system.
- A dedicated GWSRP MIS automated system should not be procured at this time. The GWSRP MIS manager should closely monitor the progress of SNAP, and any decision to procure a dedicated automated GWSRP MIS in the future should take into account the possible utilization of SNAP II shipboard hardware that is currently in the planning and testing stages.

- WQEC and NOSIH should initiate actions to attain access to a central processing unit that can support the proposed automated MIS. The CPU designated to operate the FFG-7 Class logistics data system should be used to fulfill this function. In addition, funding to support the acquisition of communication interface and data storage peripherals should be identified.

CHAPTER FOUR

GWSRP-RELATED EQUIPMENT LIFTING GEAR STATUS

4.1 BACKGROUND AND PURPOSE

The removal and installation of GWSRP-related equipment undergoing overhaul is a requirement that must be supported by various waterfront industrial facilities, specifically Navy shipyards, Shore Intermediate Maintenance Activities (SIMAs), and, to a lesser extent, Supervisors of Shipbuilding, Conversion and Repair (SUPSHIPS) activities. Because of the unique configuration of each GWSRP gun mount (3"/50 Mk 33, 5"/38 Mk 30 and Mk 38, and 5"/54 Mk 42 Mod 9 and Mod 10) special lifting gear has been designed to perform the safe removal and installation for each of these equipments. In addition, lifting rigs for gun fire control systems have been specially designed. Gun mount and gun fire control equipment lifting gear apparatus for present (and future) GWSRP cognizant equipment is described in various Naval Sea Systems Command publications as the authorized equipment for performing removal and installation operations. The concern of GWSRP managers over whether waterfront facilities do in fact have the capability to lift GWSRP equipment in accordance with the appropriate technical manual procedures has created a need to determine the actual status of the gun mount and gun fire control system lifting gear being used at the various waterfront activities.

The purpose of this analysis is to provide the cognizant GWSRP managers with an up-to-date inventory of GWSRP cognizant equipment lifting gear being used at the various industrial facilities. Recommended actions to be taken to correct discrepancies and shortages in lifting gear are provided.

4.2 DATA COLLECTION

Data collection constituted the bulk of effort expended for this analysis. The approach used was to identify the applicable lifting rigs, determine what rigs were being used by conducting an inventory of all cognizant waterfront activities, and display the results in a manner that indicated actual GWSRP equipment lifting capability. The first step was accomplished by referring to appropriate technical manuals, primarily using NAVSEA OP-1810, Revision I, Ordnance Equipment Handling and Shipping Instructions, dated 1 February 1978. A listing of the applicable lifting fixtures was obtained; it is presented in Table 4-1. The lifting fixtures are listed for

Table 4-1. GWSRP-RELATED EQUIPMENT LIFTING RIGS

Assembly Lifted	Drawing Number
3"/50 Caliber Mount Mk 33 (open) (shielded)	SK 225011-1 SK 225011-39
5"/38 Caliber Mount Mk 30 (single)	180793
Front Lifting Lug	236208-2
Rear Lifting Lug	236208-1
5"/38 Caliber Mount Mk 39 (twin)	230872-1
Front Lifting Lug	251067-2
Rear Lifting Lug	251067-1
5"/54 Caliber Mount Mk 42	733519
Lifting Bracket Mod 9	2594613
Lifting Bracket Mod 10	2873007
5"/54 Caliber Mount Mk 45	2527319
Mk 21 Barrel Lifting Fixture	2642626
76 mm Caliber Mount Mk 75	1376-97-108*
Gun Mount Shipping Fixture	1376-97-112*
Transport Base	4276-14/100/01*
Mount Foundation Drilling Fixture	4276-14-100/04*
Director Mk 68	1332821

*OTO-MELARA Drawing Number.

each gun mount and gun fire control system in the GWSRP, together with the drawing number that identifies the particular fixture. The 5"/54 Caliber Gun Mount Mk 45 and 76 mm Mk 75 are included in this table because they will be phased into the GWSRP in the future.

Most of the inventory effort was accomplished by a letter request to the Combat Systems Office (CSO) of each Naval shipyard and to appropriate SIMAs and SUPSHIP activities. In cases where responses were not received (or were incomplete), the information was obtained through telephone conversation with cognizant CSO, Shop 38, or Shop 72 personnel. In addition, an on-site visit was conducted at NOSL to discuss with the Shop 72 foreman information concerning the depot's gun mount lifting capabilities and procedures. The results of this data collection effort are presented in the following section.

4.3 CAPABILITY ANALYSIS OF GUN WEAPON SYSTEM LIFTING GEAR

The results of the data collection effort were consolidated and documented in chart form (see Appendix C of this report). Each waterfront and industrial facility was questioned (either by letter or by phone call) about its capability to lift each specific piece of equipment that falls under the purview of the GWSRP. If it was established that a capability to lift a certain equipment did exist, further information was obtained as to the date the lifting gear was last used; the general material condition of the gear; whether or not it had been certified by a weight-testing program; and, most important, if the gear itself was in accordance with the design as specified in the applicable technical manual. Pertinent general remarks were noted, as well as any serialization of equipment that might indicate if any degree of inventory control was being exercised over the equipment. A list of technical manuals and publications used as references is presented in Appendix D.

During this investigation it became apparent that the accountability of gun mount lifting pads, especially those for the 5"/54 Mk 42 gun mount, was of major concern to GWSRP management. During the past two semiannual GWSRP meetings conducted at NOSL the question of accountability of the Mk 42 gun mount lifting pads has been raised. These lifting pads are currently shipboard allowance items and are used by the waterfront facility when a removal or installation operation becomes necessary. The concern expressed at the GWSRP conference is that not enough control is being exercised over lifting pad accountability aboard ship and that, as a consequence, a timely gun mount removal becomes jeopardized if replacement pads are not located. Usually, when a requiring ship cannot locate its pads, it will borrow pads from another ship that is in port, or NOSL will sometimes manufacture a set of pads or lend one to the cognizant waterfront facility to effect a gun mount removal or installation. Within the past two years NOSL has had to send five sets of gun mount 5"/38 Mk 30 pads and two sets of gun mount 5"/54 Mk 42 Mod 9 pads to various operational units to effect a removal or installation. Some waterfront facilities have obtained or manufactured sets of gun mount lifting pads for use in the event a particular ship cannot provide pads for a gun mount removal. An inventory of these pads by waterfront facilities is presented in Appendix C.

4.3.1 Present Lifting Gear Capabilities

The waterfront facilities are currently meeting the GWSRP equipment lifting requirements levied upon them by the Type Commanders (TYCOMs). Through conversations with cognizant personnel in the various shipyards and SIMAs it appears that there is a definite "can do" attitude toward performing with the existing equipment. However, it has been determined from the written inputs of the inventory and through phone conversations with cognizant personnel at the various SIMAs and shipyards that many lifting rigs now in use have been locally manufactured and assembled and are basically not in accordance with the NAVSEA OP-1810 requirement for rigs. Appendix C reflects this status in the "general remarks" section. The cognizant personnel at the various waterfront facilities have typically stated that the

locally manufactured and assembled rigs are acceptable for use as long as they are locally certified by competent authority and as long as standard safety procedures are adhered to by the riggers who use the gear. At no point in the investigation did we find an incident in which a gun mount had been dropped because of lifting with a rig that did not meet technical manual specifications. However, a 3"/50 shielded mount was damaged when it was lifted with a rig originally designed for 3"/50 open gun mount (reference NAVORDSTA Louisville, Kentucky message R201955Z October 1978). An effort was made to correct this situation through the issuance of revised lifting arrangement drawings (SK-225011-39). It should be noted, however, that Pearl Harbor, Norfolk, and Charleston Naval Shipyards still have unmodified 3"/50 lifting rigs in their possession (Drawing Number SK 225011-1-F).

The number of authorized lifting rigs specified in the appropriate technical manual varies between the responsible waterfront facilities. Some facilities, such as Puget Sound Naval Shipyard, seem to have an adequate number of authorized lifting rigs to meet gun mount lifting requirements. Other facilities, however, are operating with locally prepared rigs that do not meet design specifications. As previosuly stated, by following standard rigging procedures, these facilities have been able to meet their lifting requirements. The problem of the inadequate number of authorized lifting rigs becomes more evident in dealings with the private sector. Private contractors are legally bound by contractual requirements and must meet Government requirements to the letter. Consequently when a private contractor is involved, the appropriate, authorized lifting gear as specified in the applicable technical manual must be used. To meet this requirement rigs must be manufactured or shipped to the facility in question. If an adequate number of authorized rigs were available, private contractors would be able to borrow them from a nearby waterfront facility and avoid shipping and manufacturing costs.

4.3.2 Lifting Gear Weight-Testing and Certification Procedures

Lifting gear for gun weapon systems must be serviced and maintained periodically to assure its maximum safety and efficiency of operation. After possession of lifting gear was established at an industrial facility, questions were asked as to the adequacy of a weight-testing program for proper certification of the gear. At NOSL, certification of lifting gear is performed in accordance with a locally prepared instruction (5ND NOSLOU 11262/1, Revision 4-77[L]), which specifies a semiannual load test (approximately 125 percent overload static test) and magna-flux inspection in addition to a prior-to-use visual inspection. This practice is in accordance with the requirements of NAVSEA OP-1810, which states: "Ordnance Handling Equipment shall be inspected prior to use. When the inspection indicates a need for testing, it shall be accomplished prior to use." NOSL, which has an almost continuous requirement for lifting rigs, seems to have highly successful and satisfactory certification procedures in effect. However, there are several facilities whose certification records of various lifting rigs are either outdated or nonexistent. The table in

Appendix C also gives a status (received as part of the lifting gear inventory) of local lifting equipment certification. Through the written inventory and numerous telephone conversations with various cognizant waterfront facility personnel, it has become evident that many facilities need to upgrade their GWS lifting gear weight-testing and certification procedures.

4.4 PROBLEM AREAS IN GWS LIFTING RIG CAPABILITIES

All aspects of the delivery of suitable gun weapon system lifting gear capability were investigated for this study. The primary problems uncovered in this investigation are as follows:

- The use of lifting gear not in accordance with technical manual specifications
- The unavailability of gun mount lifting pads to the waterfront facilities
- The inadequacy of weight-testing programs to ensure proper certification of lifting gear

These problems are discussed in the following sections.

4.4.1 Lifting Gear Procurement and Control Considerations

The widespread use of locally assembled gun weapon systems has indicated a need to preposition certain lifting fixtures at the waterfront facilities. Complete sets of appropriate lifting gear should be provided to those sites that have historically incurred requirements to handle certain gun mounts. Moreover, spare parts (e.g., unique slings, shackles) should be made readily available to the lifting sites through the supply systems or a central stockpiling point. This would preclude the use of unauthorized equipment and the need to manufacture lifting gear as parts wear or are lost. A detailed investigation into the actual gun weapon system lifting requirements of all concerned waterfront and industrial activities should be conducted to determine what types of lifting gear are to be prepositioned at a particular site. Because of present Fleet plans for striking the majority of Naval ships with installed Mk 37 Gun Fire Control System (GFCS) and the 5"/38 Mk 38 (twin gun mount) by FY 1983, it is not recommended that any widespread effort be made to supply waterfront activities with authorized lifting gear for these two systems.

Needed lifting gear could be procured through Code 161 NOSL. Issuance of lifting gear should be controlled by the Naval Sea Centers. As the initial sets of lifting gear are obtained, they should be serialized by the respective Sea Centers (NAVSEACENLANT and NAVSEACENPAC) and then distributed to the cognizant waterfront facility (SIMA or Naval shipyard), which would maintain the assigned gear. Periodic inventories of the lifting gear would then be conducted by the NAVSEACENs, thus effecting a more centralized control and accountability of GWS lifting gear. A complete listing of each unique set of lifting gear covered in this analysis is presented in Appendix E.

To develop a supply of lifting pads for the various gun mounts, the cognizant waterfront facilities could retain the pads supplied to them by afloat commands. It is expected that each waterfront facility would need, at most, three sets of pads for each type of gun mount (5"/38 Mk 30 and Mk 38, and 5"/54 Mk 42 Mod 9 and Mod 10). The pads would stay with the gun mount when it was shipped to and from the overhauling activity. After reinstallation on board ship, the pads would be retained by the installing activity. With this procedure, removal and installation operations would not be jeopardized if a particular ship did not have lifting pads aboard.

An alternative approach to solving the accountability problem of gun mount lifting pads has been proposed during previous GWSRP semiannual meetings: the development of a Ship Alteration (ShipAlt) to provide a stowage location for the Mk 42 gun mount lifting pads and the manufacture and supply for the various Fleet units that did not have lifting pads aboard. This approach is not recommended, because of the time and money that would be required to effect the ShipAlt installation with no guarantee that the pads would remain in the proper location. A detailed discussion of this alternative approach is presented in the previous progress status report (ARINC Research Publication 1665-01-SR-2136) delivered on 13 February 1980.

An alternative to prepositioning lifting gear at the waterfront activities was also explored. This alternative consisted of providing dedicated Department of Defense railroad cars with lifting gear. These cars are used in shipping the GWSs from the waterfront site to the overhaul industrial facility (nominally NOSL). The gear would then go out on an empty car to the waterfront facility to be used in the removal operation. The gear would accompany the removed GWSs as they were shipped back to NOSL, overhauled, and then shipped out again for installation. After the installation operation, the gear would be placed back on to the car and returned to NOSL. This alternative is not recommended, because of the complications that might arise in scheduling transportation and the potential of losing the gear in transit.

4.4.2 Weight-Testing Certification

There is currently adequate direction and attention at the NAVSEA level concerning the testing of ordnance handling equipment. Section 1-7 of NAVSEA OP-1810 refers to the importance of using "special handling equipment [which] has been designed for use with specific ordnance equipment for support during lifting and transporting." As stated earlier, ordnance handling equipment used ashore should be inspected before use. When the inspection indicates a need for testing, it will be accomplished before use. As specified in NAVSEA OP-1810, ordnance handling equipment includes beams, slings, crane attachments, lifting lugs, and other equipment that provides interface between the item being lifted and the prime handling equipment.

Guidance concerning specific periodic testing cycles can be obtained in the applicable engineering drawing or from the cognizant engineering code

at NOSL. Further testing guidance has been issued by NAVSEA in the form of NAVSEA NOTICE 8023 of 30 August 1979. In this notice, the maximum period between periodic tests of ordnance lifting equipment used at shoreside activities was extended from six months to one year.

The proper testing of listing equipment is also dependent on the utilization of authorized lifting gear. As specified in NAVSEA OP-1810, "accessory fittings and hardware that do not comply with drawings or specifications for the equipment should be cause for rejection." There is a prerequisite that supports the basic reason for testing lifting equipment -- to ensure that it is capable of performing with the designated capacity. Once a particular set of lifting gear has passed a weight test, it should be properly noted. Again, OP-1810 Section 1-7 provides the guidance for the specific marking of lifting equipment that has passed periodic load testing. The results of the inventory effort as displayed in Appendix C indicate that many waterfront facilities do not have or do not enforce a proper weight-testing program for ordnance lifting gear. The guidance and direction provided by NAVSEA needs to be reemphasized to the various waterfront facilities if a viable program of weight-testing and certification of ordnance lifting gear is to be maintained.

4.5 CONCLUSIONS AND RECOMMENDATIONS ON GWSRP LIFTING GEAR CAPABILITIES

From the investigation of the GWSRP lifting gear capabilities, a comprehensive inventory listing of gear maintained at each respective waterfront and industrial activity was prepared. Recommended actions and procedures have been developed for improvement of the cognizant waterfront activities' capabilities to remove and install GWSRP-related equipments, in terms of both obtaining the necessary equipment and upgrading weight-testing procedures.

4.5.1 Conclusions

The following conclusions resulted from the investigation:

- Waterfront and industrial facilities responsible for the removal and installation of GWSRP-related equipment are currently meeting TYCOM requirements to perform these operations.
- There is a widespread use of lifting gear that is not in accordance with technical manual design specifications. The use of this unauthorized gear could result in the mishandling of a gun mount or gun fire control system during removal or installation.
- Increased controls are needed to ensure accountability of gun mount lifting pads. On occasions where ships could not provide the needed lifting pads, removal operations were jeopardized until replacement pads were located.
- Adherence to weight-testing requirements for lifting gear should be stressed to ensure that the lifting gear is properly inspected and certified to perform required removal and installation operations.

- Prepositioning an adequate amount of properly designed lifting gear that is in accordance with technical manual specifications at designated waterfront activities would facilitate the proper and timely handling of gun weapon system equipment in both military and private contractor operations.

4.5.2 Recommedations

On the basis of the investigation conclusions, the following recommendations are offered:

- Waterfront facilities required to perform gun weapon system removal and installation operations should be provided with lifting gear that meets technical manual specifications.
- A greater degree of control should be exercised over the maintenance of gun weapon system lifting gear. NAVSEACENs, for both Atlantic and Pacific Fleets, should be designated as the cognizant authorities and supervise the procurement, serialization, and periodic inventory of lifting gear.
- Spare parts for each unique set of lifting gear should be made readily available either through the supply system or via a central stockpile point so that integrity of a complete set of lifting gear can be maintained.
- Stockpiling of gun mount lifting pads should be instituted at designated waterfront facilities to ensure that an adequate supply of lifting pads is made available for gun mount removal and installation operations. This can be achieved by directing each cognizant waterfront activity to retain lifting pads used in gun mount removal operations until they have an adequate number of lifting pad sets to sustain themselves.
- An investigation into the present and future gun weapon system lifting requirements that each waterfront and industrial facility will experience or is currently experiencing should be conducted so that authorized lifting gear can be properly allocated.
- Safety standards for the weight-testing and proper certification of gun weapon system lifting gear should be reemphasized.
- Widespread allocation of authorized lifting gear for Mk 37 GFCSs and 5"/58 Mk 38 twin gun mounts should not be undertaken, because the majority of ships outfitted with these systems will be removed from the Fleet by FY 1983.

CHAPTER FIVE

ANALYSIS OF CLASS MAINTENANCE PLANS AND GWSRP/DDEOC SCHEDULING INTERFACES

5.1 BASIS FOR APPROACH

Over the past two years GWSRP principals have identified and investigated several areas of potential interface between their program interests and those of the DDEOC Program. Since June 1978 three coordination studies have been completed. The initial study (ARINC Research Publication 1655-01-1-1779) developed eight areas of interface potential between the two programs. Two of the original eight recommended areas of integration investigation were (1) CMP and (2) GWSRP and DDEOC Program Scheduling Interface. It was determined that the addition of GWSRP management and engineering information to DDEOC CMPs would enhance identification of the anticipated maintenance for GWSs during an engineered operating cycle. The analysis of GWSRP and DDEOC program requirements indicated the desirability of coordinating and phasing the scheduling efforts of the two programs.

These two tasks were conducted by using approaches similar to those used in earlier studies. The initial effort conducted for both tasks was to collect the available information on DDEOC CMPs and schedules from available documents and personal interviews. This information was compared with existing GWSRP maintenance requirements and scheduling procedures. Recommendations concerning integration actions were developed as the last phase of the effort.

The analysis in these task areas also concerned developing similar integration recommendations for emergent EOC programs. The emergent EOC maintenance and scheduling requirements were analyzed and compared with GWSRP. Where no requirements or schedules had been developed for an emergent EOC program, analysis was directed toward recommending maintenance and scheduling action based upon anticipated program needs.

5.2 CLASS MAINTENANCE PLAN ANALYSIS

Efforts were concentrated on analyzing those CMPs developed by the DDEOC Program. Discussion of the analysis efforts is preceded by a description of the CMPs, as provided in the DDEOC Program Management Plan.

5.2.1 CMP Development Background

The DDEOC CMP defines restorative and corrective maintenance requirements for specific systems and equipments of DDEOC ships throughout the EOC. It provides the framework for implementing an engineered maintenance program designed to maintain ship material condition at an acceptable level, with increased operational availability during the cycle. With specific exceptions, each CMP includes significant maintenance-oriented actions that are predictable during the operational cycle defined by the DDEOC Program. The CMP does not include Planned Maintenance System (PMS) routines to be accomplished by ship's force, alterations and field changes, unique or unusual repairs, or repairs and minor maintenance procedures that are not essential to the ship's operation. Two major categories of tasks are included in the CMP, "Engineered Maintenance Requirements" and "Qualified Maintenance Estimates."

5.2.1.1 Engineered Maintenance Requirements

Engineered maintenance requirements are specific tasks to be performed at defined intervals by depot or intermediate maintenance activities. The only organizational maintenance tasks that appear in the engineered category are those required in support of Intermediate Maintenance Activity (IMA) or depot requirements, such as in the ship-to-shop or provide-assistance categories. Typical engineered tasks include:

- Turnaround restoration programs or Class B overhaul
- Fundamental tests and inspections
- PMS actions requiring outside assistance
- Other well defined maintenance tasks

All engineered tasks are to be accomplished at established frequencies.

5.2.1.2 Qualified Maintenance Estimates

Qualified maintenance estimates represent probable corrective tasks that engineering analysis or historical data indicate will be encountered. However, specific definition of the scope or frequency (or both) of maintenance action is lacking. These estimates apply to all levels of maintenance and are included in the CMP as reservations for manpower planning. Typical qualified tasks include:

- PMS actions that require outside assistance but are performed only when conditions demand
- Repair actions to be identified by the Current Ships Maintenance Project (CSMP)
- Repair actions resulting from inspections
- Cost-of-business tasks during scheduled availabilities, such as drydocking, staging, and fire watches

Qualified tasks are to be performed as required. The frequencies that appear in the CMP for these tasks are the product of statistical analysis to estimate the probable corrective maintenance burden in an extended operating cycle.

5.2.2 Analysis of Existing CMPs

Analysis of CMP items, both engineered and qualified, was conducted. This analysis concentrated on the guns and gun fire control systems found on the FF-1052, DDG-37, CG-26, and DD-963 Classes. All of these classes have developed CMPs that have undergone or are undergoing appropriate NAVSEASYSCOM review. The CMPs for FF-1052 and DDG-37 Classes have been promulgated; those for CG-26 and DD-963 Classes will be promulgated in the near future. Except for DD-963, all CMPs for the aforementioned classes should have been promulgated by the time this report is released.

The CMP task items analyzed were those applicable to only the guns and GFCSs. Those items can be found in the SWAB 4811 and 7111 series tasks of the DDEOC CMPs. Appendix F lists each engineered and qualified task by number, brief description, total man-hours required, and periodicity. The CMP tasks are prescribed, with the required level of maintenance. The levels of maintenance of greatest concern to this effort are the intermediate and depot level. In most cases these levels of maintenance will require the assistance of the following types of activities: afloat tender, SIMA, Mobile Technical Unit (MOTU), NAVSEACEN, NOSL, or private contractor. The scheduled organizational level of maintenance is not of immediate concern to this analysis. Organizational maintenance should be accomplished by the ship's force, and the scheduling of such items in a CMP does not project a requirement for integrative action by the GWSRP.

The majority of CMP tasks designated as requiring the organizational level of maintenance specify repairs to be accomplished as indicated by Preoverhaul Test and Inspection (POT&I) results and the Current Ship's Maintenance Project (CSMP). The CSMP provides shipboard maintenance managers with a consolidated listing of deferred corrective maintenance with which to manage and control accomplishment of the CSMP. It is assumed that by including organizational level CMP tasks, the DDEOC Program intends to point out the necessity for accomplishing shipboard maintenance on a fairly predictable basis above and beyond scheduled PMS. Therefore, this analysis did not provide an in-depth study of those CMP tasks planned at the organizational level. Table 5-1 summarizes (by class) the amount of maintenance specified at each of the three levels of maintenance required during the first notional engineered operating cycle.

It should be noted that this study was based on the CMP tasks required during a notional cycle. There are specific tasks with periodicities that place them outside the first notional cycle. The FF-1052, DDG-37, and CG-26 Classes have four similar tasks that fall into that category. The tasks are listed in Table 5-2 with their appropriate task frequency. The 7111-XX task will increase the amount of depot level maintenance required in these three classes by as much as 250 percent during the second complete

Table 5-1. CMP REQUIRED MAN-HOURS INDICATED BY LEVEL OF MAINTENANCE				
Level of Maintenance	FF-1052 Man-Hours (Percent)	DDG-37 Man-Hours (Percent)	CG-26 Man-Hours (Percent)	DD-963 Man-Hours (Percent)
Organizational	3,360 (28)	3,360 (23)	3,507 (31)	0 (0)
Intermediate	492 (4)	492 (3)	172 (2)	90 (1)
Depot	8,152 (68)	10,840 (74)	7,540 (67)	6,210 (99)
Total	12,004 (100)	14,692 (100)	11,219 (100)	6,300 (100)

Table 5-2. SPECIFIC CMP TASKS DURING SECOND NOTIONAL CYCLE			
Task	Man-Hours/Frequency (i.e., every x months)		
	FF-1052	DDG-37	CG-26
E4811-XX = Replace the Mk 16 Mod ( ) Stable Elements including the Mk 156 Mod ( ) Control Panel and Mk 36 rate transmitter with a refurbished unit	250/120	250/120	250/120
E4811-XX = Replace the Mk 47 computer with a refurbished unit	250/120	250/120	250/120
E4811-XX = Replace AN/SPG-53 ( ) radar, including the radar signal processing equipment, with a refurbished unit; does not include the Mk 38 antenna scanner	250/120	250/120	250/120
E7111-XX = Accomplish Class B overhaul of the 5"/54 Mk 42 Mod ( ) or mount turnaround at NOSL	18,800/144	18,800/120	18,800/120

notional cycle. It also represents a key area of integration with the GWSRP since the task basically recommends an overhaul of the gun mount.

The CMP items presented in Appendix F indicate that the DDEOC Program has increased the number of engineered and qualified maintenance tasks since the mid-year report was submitted. The added tasks basically involve the requirement to replace particular equipments with refurbished units during the second Regular Overhaul (ROH) (the 120-month point). The additions have also served to align the CMP tasks for the FF-1052, DDG-37, and CG-26 Classes because of the similarity of the gun and fire control equipments. There have also been revisions to the earlier CMPs (FF-1052 and DDG-37 Classes) to incorporate the justifications and rationale used to develop the subsequent CMPs.

The review of both the engineered and qualified tasks indicates that the procedures used to develop the CMP tasks have resulted in an increased interface between GWSRP and DDEOC personnel for establishing tasks and frequency. CMP tasks are originated by several sources (e.g., ship's force, TYCOM, NAVELEX, NAVSEA) and reviewed by PERA (CRUDES). The reviewed items are submitted to NAVSEA-931X for approval before they are promulgated. PERA (CRUDES) and NAVSEA-931X personnel report that every effort is made to obtain a technical input or review comment on each proposed CMP task with the appropriate NAVSEA technical code before the task is included in the class plan as an approved item. Virtually all of the qualified tasks state "Accomplish Class C repairs as indicated by POT&I results and ship's CSMP." This is a significant task statement for several reasons:

- The initial CMPs did not contain tasks with Class C repairs. Although the majority of the Class C-oriented CMP tasks are directed toward the organizational level of repair, they do provide maintenance managers with advanced planning requirements necessary to keep the ship's equipment in a satisfactory readiness condition throughout an operating cycle of 54 ± 6 months.
- The gun weapon system portion of the POT&I is to be conducted in accordance with GWSRP procedures and checklists used in the MCR. [This agreement was made between PERA (CD) and NAVSEA-62YGB on 12 June 1979.]
- The inclusion of the CSMP as an indicator for scheduled maintenance would bring into consideration those deferred items that resulted from MCRs, Combat System Readiness Review (CSRR), and Combat System Readiness Test (CSRT). Any discrepancies noted on the MCR, CSRR, and CSRT inspections that were not corrected during the inspection period would be deferred until it was feasible to correct them.

The qualified tasks for all four ship classes are representative of a more flexible maintenance strategy that depends on repairs being performed as a result of observed equipment condition. Since a majority of these Class C tasks are scheduled with task frequencies of 18 months, there will be an increased emphasis on the use of the CSMP. Inspections that are conducted between ROHs will ultimately result in many of the deferred

actions that appear in the CSMP. Therefore, it is important to this coordination effort that the GWSRP program continue to emphasize its inspection program, because it provides many of the data that will define the work required by the qualified CMP tasks.

The engineered tasks listed in Appendix F indicate that the DDEOC Program still emphasizes the use of Class B overhaul of major gun weapon equipments and systems. The FF-1052, DDG-37, and CG-26 Classes all have engineered tasks that require Class B overhaul of the following equipments during the first overhaul following entry into the DDEOC Program:

- Mk 47 Computer
- AN/SPG-53 (Mods) Radar Set
- Radar Signal Processing Equipment
- Mk 16 (Mods) Stable Element
- Mk 156 Control Panel
- Mk 36 Rate Transmitter
- 5"/54 Gun Mount Mk 42 Mods

The stated requirement to perform a Class B overhaul on each of those equipments during the first overhaul should not result from CMP tasks, but rather from an in-depth preoverhaul inspection conducted by qualified inspectors. The use of CMP items to provide data to the Ship Alteration and Repair Package (SARP) could result in conflicting work requirements. The POT&I conducted on those equipments may in fact determine that a less significant or more significant overhaul is required depending on each ship's individual equipment. The blanket requirement to "Class B overhaul" these equipments every 60 months could prove to be costly, as historical data indicate. (Ships overhauled in the private sector often have experienced significant problems in their combat systems.) The sophistication of the guns and GFCS requires repair expertise that is not commonly found in most repair facilities. Requiring Class B overhaul of a sophisticated system without prior consideration of system condition or the facility assigned to conduct the overhaul is not in the best interests of the ship, GWSRP, or DDEOC Program. Those CMP items requiring Class B overhaul of gun weapon systems should be changed to read as follows: "Perform specific repairs in accordance with POT&I." The GWSRP community has maintained that for these types of equipments the level of work can be accurately determined only as a result of a ship-by-ship inspection of each equipment's physical and operational condition.

There is evidence that the requirement for Class B overhaul for gun weapon system-related CMP tasks is being deemphasized. The Class B overhaul of equipments and systems is a costly and labor intensive maintenance action. By following the recommendations of preoverhaul inspections, repairs can be effected that are more specifically directed toward improving the material condition for the particular equipment and system in question. The DDEOC Program CMPs were developed in the following order: (1) FF-1052, (2) DDG-37, (3) CG-26, and (4) DD-963. Of these four classes,

the more recently developed DD-963 specifically mentions accomplishing maintenance actions in accordance with a preoverhaul inspection, namely, the MCR, which concerns GWSRP-related equipment and systems. In addition, the revised edition of the FF-1052 CMP has indicated a greater reliance on the use of preoverhaul inspections.

The qualified tasks for all classes essentially advocate Class C repairs in accordance with POT&I or prearrival inspection results for many of the major gun weapon systems and equipments. The inclusion of modular replacement of many equipments and systems during the second overhaul (120 months) following entry into the DDEOC Program indicates a change in CMP tasking. These two developments represent a trend away from dependence on the Class B overhaul philosophy. Continued emphasis on reduction of the remaining Engineered Tasks describing Class B overhauls should be pursued by NAVSEA-62YG in an attempt to align work packages more closely with actual inspection results. This is especially important for engineered tasks designated with a frequency of every 60 months or ROH. Those CMP items calling for Class B overhaul during the ROH should be amended.

5.3 EMERGENT EOC PROGRAMS

Three emergent engineering maintenance programs of potential interface interest are the Amphibious Engineered Operating Cycle (PEOC), the Mobile Logistics Support Force (MLSF), and the FFG-7 Lo-Mix Program. The MLSF is often referred to as Auxiliary Engineered Operating Cycle (XEOC). These programs are in their initiation phases to develop engineering management and maintenance planning strategies similar to those developed by the DDEOC Program. Funding has been authorized and budgeted for initial program commitments in FY 1981.

5.3.1 PEOC and XEOC Program Review

The PEOC and XEOC programs will incorporate, by priority, the following ship classes:

PEOC	XEOC
LHA	AFS
LPH	AOE
LPD	AOR
LSD-36	AD
LST	ATS
LKA	

Program management responsibility for the PEOC Program and the XEOC Program resides with PERA (ASC) and PERA (CSS), respectively. Both programs are currently proceeding with initial definition of their program requirements, which includes such milestones as identification of objectives and constraints, assessments of current ship status, definition of maintenance strategy, and establishment of current versus projected program

requirements. The Ship Support Improvement Project, Naval Sea Systems Command, released an Engineered Operating Cycle Program Development Manual (NAVSEA T9080-AA-PRO-010-EOC) in August 1978 to assist program management in developing an integrated EOC Program. It is designed to serve as a reference for EOC program managers during three distinct program phases: Initiation, Development, and Implementation. Although the three distinct phases are recommended, they serve only as guidelines, which are neither restrictive nor all inclusive. This is worth mentioning because it initially appears that both PEOC and XEOC will be guided by many of the broad principles explained in the EOC Development Manual, but these programs will not necessarily contain all the milestones recommended in the three distinct phases. Milestones specifically recommended for accomplishment in one of the three phases may be either deleted or sequenced to occur in another phase depending on time and budget contraints.

Initial planning indicates that each class of ships in PEOC and XEOC will be managed independently of the other classes in their respective programs. PEOC and XEOC Programs project the following milestones for accomplishment on a program-versus-class basis:

- Development of Program Management Plan
- Development of Program Effectiveness Procedures
- Development of MIS

It is possible for each class to have individualized objectives, constraints, and cycle length. It will be important to track the development of the PEOC and XEOC Programs to ensure that those areas individualized by ship class are noted and interfaced with separately if required.

Both PERA (ASC) and PERA (CSS) have indicated that the maintenance strategies for each program will include CMPs. The CMPs are intended to define and schedule anticipated maintenance requirements for systems and equipments of each class throughout the designated operating cycle. Naval Sea Systems Command Letter Serial 301-041B of 14 December 1979 lists a detailed Plan of Action and Milestones (POA&M) for "major supporting actions" in the Amphibious and Auxiliary EOC Programs. One of the major supporting actions listed is "development of class maintenance plan." The earliest projected start date of that milestone for any class is October 1980 for the LHA Class. Earliest completion (for the LHA Class) of the preliminary CMP milestone is projected as October 1981. The GWSRP has an excellent opportunity to provide input to both programs before the completion of any CMPs. This could prove valuable to all ship classes.

Coordinated inputs could ensure that the GWSRP maintenance philosophy guides the cyclic maintenance of PEOC and XEOC GWSs. Concurrently the PEOC and XEOC Programs can take advantage of the significant gun weapon system maintenance experience that GWSRP has accrued. This experience could be applied to the development of strategy as well as specific maintenance requirements. In view of proposed Close-In Weapon System (CIWS) installations, only Destroyer Tender (AD) and Salvage and Rescue Ship (ATS) classes will not have on-board gun weapon systems. The majority of GWSs

found on the PEOC and XEOC classes are 3"/50 caliber guns. The development of anticipated maintenance plans for these systems should take into account the 3"/50 Gun Weapon System Improvement Program (GWSIP). The purpose of the 3"/50 GWSIP is to provide for Fleet-wide establishment and support of the 3"/50 GWSIP in accordance with Chief of Naval Operations (CNO) guidelines and in support of the gun concept. CNO directed that the primary mission of the 3"/50 guns be changed from Antiair Warfare (AAW) to Surface Warfare (SSW), providing efficient and reliable surface capability to 3"/50 armed ships.

The GWSIP will provide for immediate implementation of three program elements -- Mk 2 Mod 13 Loader, Mk 172 amplifier, and Mk 23 TDT upgrade and replacement -- as part of the upgrading of surface capability. These changes have been designed and developed for installation during depot overhaul or dockside by qualified MOTU and SIMA personnel. The GWSIP management plan has identified ship overhaul and availability schedules of PEOC and XEOC ships for installation of the improvements.

Since these long-range schedules are subject to change, it is important that both program offices be aware of the planned dates for GWSIP improvements. Coordination between GWSIP and PEOC and XEOC Program Managers is mandatory to ensure timely accomplishment of these improvements. The installation of these improvements will affect shipboard maintenance requirements and should be reflected accordingly in the CMPs.

5.3.2 FFG-7 Lo-Mix Program Review

The FFG-7 Class Lo-Mix Program is the last program that was investigated for emergent EOC integration possibilities. The FFG-7 program maintenance concept has focused on use of the following strategies:

- Modular replacement whenever possible.
- Rework of repairables at a depot-level rework facility for return to repairable stock.
- Fix-when-fail strategy rather than hardtime strategy as is used extensively in Hull, Mechanical, and Electrical (HM&E) systems. Hardtime strategy cannot be justified for Combat Systems until sufficient failure rate data are accrued.
- Complete overhaul of isolated Combat System equipments during an Intermediate Maintenance Availability (IMAV) or Selected Restricted Availability (SRA).

Systems that would be of primary interest to the GWSRP are the Mk 92/2 Weapon Fire Control System, Mk 75/0 Gun System, and CIWS Phalanx Mk 15 when installed. The Mk 92/2 Weapon Fire Control System maintenance philosophy consists of repair at the organizational and depot levels of maintenance. Intermediate-level maintenance consists strictly of removal and replacement services for heavy units and calibration of test equipment. Repairs at the organizational level normally consist of planned maintenance

prescribed by the PMS; fault isolation; and corrective maintenance consisting of replacing modules, assemblies, subassemblies, or components. Depot-level maintenance will consist of overhaul or repair of modules, designated replacement units, printed circuit boards, and electromechanical assemblies, as well as complete system overhaul and refurbishment.

The Mk 75/0 Gun System requires organizational-, intermediate-, and depot-level maintenance support. Organization-level preventive maintenance is limited to performing maintenance actions in accordance with the appropriate Maintenance Requirements Cards (MRCs). Corrective maintenance actions will be in accordance with the Source, Maintenance, and Recoverability (SM&R) codes listed in Allowance Parts Lists (APLs). Failed items will be replaced by modular change-out. Intermediate-level maintenance will consist of component and module replacements that are beyond the capability of the organizational level. SIMA support has been planned. Depot-level maintenance will consist of all maintenance actions and overhaul beyond the capability or capacity of the aforementioned maintenance levels. Failed major components will be reworked at depot-level rework facilities and returned to repairable stock.

The modular change-out program planned for the FFG-7 Class will have the greatest impact on the GWSRP to establish sufficient rotatable pool stocks. Accurate levels and component types must be established to permit timely and sufficient turnaround of repairables. Maintenance planning for this type of maintenance program will have to include accurate forecasting and submission of budgets to support a rotatable rework program.

5.4 GWSRP AND DDEOC PROGRAM SCHEDULING INTERFACE

The scheduling interface analysis was focused on comparing the DDEOC Program's maintenance scenario with that of the GWSRP. The comparison was used to determine what impacts, if any, would require integration efforts between the two programs. The notional DDEOC maintenance scenario and CMP tasks for gun weapon systems (Tasks 4811-XX and 7111-XX) were the basic information reviewed.

5.4.1 DDEOC CMP Scheduling Background

Initially, it should be understood that both DDEOC Program and GWSRP scheduling concerns are coordinated at the OPNAV and TYCOM levels and subject to their control as long as the ship is in a Fleet operational status. The GWSRP is primarily concerned with the overhaul or replacement of ordnance installed. GWSRP overhaul of gun weapon systems found on DDEOC Program ships requires that repairs be accomplished primarily at or by a depot-level facility. The DDEOC Program is concerned with the maintenance of ship systems and equipments based on engineered evaluations of requirements for periodic maintenance throughout a designated operating cycle. Basically this cycle has been designated as 54 ± 6 months for the DDEOC Program ship classes. The DDEOC Program has developed an EOC maintenance scenario for each promulgated class CMP. This scenario has as a basis a

notional cycle 60 months long, ending with an ROH. Within the cycle are three operational deployments and two SRAs. Throughout this study the 60-month scenario was used for analysis.

The DDEOC Program defines a class engineered operating cycle maintenance scenario as "an idealized plan for ship maintenance." This scenario, which is developed for a typical ship of the class, identifies the DDEOC requirements and schedules at all levels of maintenance. The scenario is based on the maintenance requirements and the ship's typical operating profile. It provides an overview of the maintenance burden anticipated throughout a notional operating cycle and the framework for forecasting and budgeting maintenance resources necessary to execute the maintenance strategy developed for the class.

The DDEOC maintenance scenario is based on the assumptions that all BOH tasks have been completed and that the elapsed time since completion of all tasks was zero at the end of BOH. Since this situation is unlikely to occur on any ship, this scenario cannot be used to determine the amount of CMP work that will be scheduled for accomplishment during the EOC for a specific ship. A maintenance summary is presented in the CMP to display the magnitude of the maintenance for a notional ship over an entire cycle. Individual work packages are developed by PERA (CRUDES) in accordance with established milestone schedules.

5.4.2 Analysis of GWSRP/DDEOC Program Scheduling Interface

To assess the degree and frequency of maintenance burden anticipated over a notional cycle for GWSs, the scheduling chart in Appendix B was developed. This chart displays the notional schedule (indicated at the top), with the anticipated maintenance burden listed by class below the cycle at its scheduled frequency. Each task is listed by DDEOC task number and total task man-hours. The task man-hour total equals the number of designated task man-hours per equipment times the number of equipments commonly found on a typical ship of the class. (Example: for FF-1052 Class, E4811-05 states "Overhaul Mk 68 Gun Director Amplidynes and Motor Generators." This was assigned 100 man-hours per equipment, and there are commonly three equipment per ship. Thus total task man-hours are 300).

Analysis of the anticipated maintenance burden in relation to the DDEOC notional schedule provides insight into some of the TYCOM planning requirements necessitated by each specific availability. The intercycle availabilities will be of considerable importance to each DDEOC Program ship because the ROHs will occur less frequently. The emphasis will be on orderly intracycle planning to ensure that all systems operate satisfactorily up until a major shipboard overhaul availability during ROH. The CMPs provide the TYCOMs with a list of tasks to enter into each ship's repair package. It is imperative that the validity of each item be checked with respect to the particular ship being made available, particularly for GWSs that may be undergoing an availability in the private sector.

The CMPs specify maintenance at the organizational, intermediate, and depot levels. These in turn are assigned frequencies within the required operating cycle. As each availability is planned, the CMP items provide a distinct input into the planning process. One of the initial scheduling criteria that should be maintained is recognition by the GWSRP that each DDEOC Program ship will undergo an engineered operating cycle that is committed to the designated availabilities at approximately those time periods shown on the notional cycle. This information can be invaluable when used to accomplish significant intracycle repairs. Currently scheduled intracycle CMP items are minimal for the GWS. Table 5-3 shows the number of CMP man-hours designated for ROH as opposed to the intracycle.

Table 5-3. COMPARISON OF SCHEDULED GWS-RELATED CMP MAN-HOURS

Class	Total CMP Man-Hours	ROH Man-Hours	Percentage of Total	Intra-cycle Man-Hours	Percentage of Total
FF-1052	12,004	7,208	60	4,796	40
DDG-37	14,692	9,896	67	4,796	33
CG-26	11,219	7,984	71	3,235	29
DD-963	6,300	6,210	99	90	1

Table 5-3 shows that the ROH has been designated the most active period for CMP tasking. More than 60 percent of all assigned CMP man-hours have been scheduled for completion during ROH. The intracycle CMP man-hours for all classes are minimal for the next most significant availability -- SRAs. The SRAs consist of two six- to eight-week periods scheduled to occur at approximately 18-month intervals. The objective of using SRAs at these intervals is to provide reasonably predictable CMP task-accomplishment periods to sustain the equipment during an extended overhaul cycle. The effect of the baseline overhaul will be to restore or review many systems and equipments with expected lives of greater than the 18-month period to the first SRA. This holds true for the work packages developed as a shipboard basis for the four classes. For the Gun Weapon Systems, the utilization of the SRAs is minimal. For the FF-1052, DDG-37, and CG-26 Classes, 480 hours of depot-level repairs have been assigned by a 7111-XX task for guns and mounts during SRA. No SRA work has been assigned in these classes relative to the GFCS (Tasks 4811-XX). The DD-963 Class has two CMP tasks assigning work to the SRAs. Both of these tasks are for the GFCSs and require a total of 470 man-hours.

Thus for any DDEOC class ship no more than 480 man-hours of GWS SRA work will be planned. This is the equivalent of 60 man-days of work over a six-week period. Given that a six-week period has 30 workdays, the scheduled SRA work requires no more than two men per day for the duration of the availability on DDEOC ships that all have a minimum of a 5"/54 gun (DD-963 Class has two) and a major supporting fire control system (Mk 68 or 86).

This relatively minimal tasking might be further reduced since its task description states "to accomplish Class C repairs as indicated by prearrival POT&I results and ship's CSMP." That statement indicates (1) that some types of pre-SRA inspection will be conducted and (2) that the results of the inspection will identify work to be accomplished during that specific availability. If the preavailability inspection does not indicate the need for Class C repairs, the availability work package will be based on the CSMP. It is important to both the GWSRP and the DDEOC Program that the preavailability inspection be specific, current, and documented. This inspection should be conducted by qualified inspectors whose interests are not tied to the productivity of the overhauling activity. These periods are too short and critical to equipment survivability during the extended overhaul cycle to be used for "make work." The GWSRP should review and comment on the preavailability (SRA) inspections conducted on GWSs in the same way as for CMP tasks.

It is in GWSRP's interest to be continuously aware of each DDEOC ship's schedule with regard to availabilities. The SRAs and ROH both provide the opportunities to perform corrective maintenance associated with the GWSRP. The SRAs are extremely important. Proper planning and scheduling of materials and equipment can allow the maximum utilization of these periods to conduct comprehensive change-out or refurbishment of GWSs. Proper logistics planning is imperative for a six- to eight-week availability; thus the GWSRP has to maintain minimal tracking on a quarterly basis for each ship's projected schedules. It is recommended the GWSRP add SRA schedules for all DDEOC Program ships to one of the current management reports maintained by WQEC, Concord. These schedules should be kept on an individual ship basis as are ROH schedules.

Another important aspect of the intracycle CMP scheduling interface that GWSRP should be aware of is the use of largely organizational-level CMP tasks for the GWSs. Table 5-4 shows the number of organizational man-hours versus total CMP intracycle man-hours.

Table 5-4. ORGANIZATIONAL-LEVEL MAN-HOURS AS A PERCENTAGE OF TOTAL INTRACYCLE MAN-HOURS

Class	Total Intracycle CMP Man-Hours	Organizational-Level Intracycle Man-Hours	Percentage of Intracycle Man-Hours
FF-1052	4,796	3,360	70
DDG-37	4,796	3,360	70
CG-26	3,235	2,061	64
DD-963	90	0	0

With the exception of the DD-963 Class, the intracycle maintenance scheduled for DDEOC Program ship's GWSs is largely organizational. Therefore, interface with the GWSRP does not occur. The exceptions are situations in which ship's force is qualitatively or quantitatively undermanned and must seek outside assistance. The requirement for outside assistance might affect the GWSRP, because the NAVSEACENs are often the primary activities called upon to provide the requisite assistance. Essentially the intracycle maintenance specified by the DDEOC Program for GWSs is organizational, with the greatest amount of nonorganization-level maintenance occurring during the SRAs. The need for intracycle scheduling interface is greatest during the SRAs. These availabilities provide the GWSRP with excellent opportunities for major system replacement or refurbishment.

5.5 CONCLUSIONS AND RECOMMENDATIONS

From the analysis of the CMP task items and GWSRP and DDEOC scheduling interfaces, recommendations were developed for improvement and integration of each program's interest in these areas. The program action that will be required to implement the recommendations relies largely on keeping open effective channels of communication between the two programs.

5.5.1 Conclusions

The following conclusions resulted from the study:

- CMP repair requirements for GWSs specifying Class B overhaul of equipments are not sufficiently specific. Repairs can be specified in accordance with the results of the preoverhaul test and inspection. Indiscriminate use of Class B overhaul on GWSs leads to inefficient and unnecessary repairs.
- More than 60 percent of all completed CMP tasks for GWSs are designated for depot-level maintenance. Virtually all of these tasks are scheduled for completion during ROH.
- The DDEOC Program CMPs (excluding the DD-963 Class) recommend replacement or a complete turnaround -- at the second overhaul following program entry -- of the Mk 16 Stable Element; Mk 156 Control Panels; Mk 36 Rate Transmitter; Mk 47 Computer; AN/SPG-53 Radar, including the Radar Signal Processing Equipment (RSPE); and 5"/54 Mk 42 Gun Mount. These items represent the greatest accumulation of man-hours assigned for GWSs.
- The DDEOC Program CMPs have indicated that the communications between the two programs have enhanced utilization of the GWSRP maintenance philosophy in CMP tasks. The inclusion of the statement "Class C repairs as indicated by POT&I results and ship's CSMP" is indicative of this interface.
- Emergent EOC programs are beginning to initiate and develop their respective maintenance requirements. These requirements have both old and new GWSs, which will have to be addressed in EOC planning efforts.

- The DDEOC Program has scheduled virtually all GWS maintenance requirements for the SRAs or ROH. The successful designation and accomplishment of the necessary work requirements for these types of availabilities will be predicated on preavailability inspections. The GWSRP inspection program is critical to this effort.

5.5.2 Recommendations

On the basis of the study conclusions, the following recommendations are offered:

- The DDEOC Program CMP repair requirements specifying Class B overhauls on specific equipments of GWSs should be amended. Repairs should be in accordance with the results of preavailability inspections. The GWSRP should continue to press for this change to reduce emphasis on blanket Class B tasks.
- The GWSRP should continue to review and contribute to the DDEOC Program CMPs. This effort should be concentrated on depot-level maintenance scheduled for ROH, because such maintenance represents the majority of scheduled tasks.
- The GWSRP should ensure that GWS requirements specified for the second overhaul (after entry into the DDEOC Program) are planned for in its budget requests and are consistent with the GWSRP inspection determinations.
- The GWSRP and the DDEOC Program should continue to maintain close and open lines of communication to ensure that the technical and management aspects of each program derive benefits from the expertise of the other.
- The GWSRP should take the initiative with emergent EOC programs, e.g., PEOC, XEOC, and FFG-7, in providing guidance for the development of overhaul and intracycle GWS maintenance requirements.
- The GWSRP should continue to emphasize its Material Condition Review inspection program for GWSs. These inspections should provide to the DDEOC Program the basis for planning scheduled SRA and CMP task requirements. The GWSRP should emphasize coordination of scheduling requirements for the DDEOC Program SRAs and ROHs.

CHAPTER SIX

SUPPORT AND COORDINATION OF GUN WEAPON SYSTEM REPLACEMENT

Efforts of previous engineering and management support contracts were centered on the integration of the GWSRP and the DDEOC Program. The primary objective of the effort reported on herein was to investigate, analyze, and report developing GWS maintenance requirements. ARINC Research personnel attended meetings to obtain and provide information on contract tasks (see Table 6-1). In addition, they provided technical oversight to several efforts encompassing future EOC programs' GWS maintenance planning studies to assure that GWSRP out-year production schedules would not be adversely affected by class maintenance planning.

Table 6-1. MEETINGS ATTENDED IN SUPPORT OF GUN MAINTENANCE

Subject	Location	Date
OrdAlt research	NOSIH	28 July 1980
Work Order progress (lifting gear)	NOSIH	12/26 September 1979
FMP concerning GWSRP	NAVSEASYSCOM	26 October 1979
OrdAlt installation and lifting equipment	NAVSEACENLANT/ NAVSEA NORDIV	13 November 1979
Semiannual GWSRP and FMP planning	NOSL	14-15 November 1979
Contract review	ARINC Research Corporation	20 November 1979
Automated GWSRP MIS	NOSIH	13 December 1979
Class maintenance plan reports	NOSIH	11 February 1980
Semiannual GWSRP and FMP planning	NOSL	24-27 March 1980
Automated GWSRP MIS/ lifting equipment	WQEC, Concord/ SEACENPAC	14-17 April 1980
NOSIH, computer facility capabilities	NOSIH	9 May 1980
GWSRP inspections	COMNAVSURFLANT	21 May 1980

6.1 GWSRP-RELATED STUDIES

As recommended in ARINC Research Publication 1661-01-1-2010, four areas of interest to GWSRP planning were (1) program status of approved OrdAlts; (2) on-line terminal installation for GWSRP MIS; (3) waterfront equipment lifting capabilities; and (4) GWSRP integration with emergent EOC programs. Items 1 through 4 have been reported in preceding chapters. This section addresses 3"/50 caliber gun mount improvement planning and its relationships with other Navy activities, and items of general interest to GWS maintenance planners.

6.1.1 3"/50 Caliber Gun Weapon System Improvement Program (GWSIP)

During the period September 1979 through July 1980, NAVSEASYSCOM and NOSL, continued to develop and acquire two significant OrdAlts for 3"/50 gun systems remaining in the Fleet. These OrdAlts, 9335 and 9409, are planned for delivery commencing in late 1980 and early 1982, respectively.

Installation of OrdAlt 9335, which provides a two-sprocket loader mechanism (Mk 2 Mod 13) instead of the three-sprocket loader mechanism, will be incorporated into oscillating assemblies at NOSL only. Twenty-four depot installations are planned in conjunction with GWSRP mount overhauls from 1981 through 1985. The remainder of the OrdAlts (9335) are planned to be installed into the oscillating assemblies at NOSL; subsequently these oscillating assemblies (with OrdAlt 9335) will be installed from 1981 through 1986 at various waterfront sites as permitted by ship schedules.

In the case of OrdAlt 9409, which provides a solid-state amplifier Mk 172 replacement for the old Mk 40 vacuum tube amplifiers, installations can be accomplished aboard ship or at the depot. These installations are currently planned for 1982 through 1987 in conjunction with GWSRP overhauls and waterfront activities.

6.1.1.1 3"/50 GWSIP Organization

Development and acquisition of GWSIP OrdAlts 9335 and 9409, as well as any additional future improvements, are under the technical direction of NAVSEASYSCOM (SEA-62Y11G). NOSL provides program support to SEA-62Y11G in all aspects of design and acquisition.

Because the gun improvement process is so closely allied to depot overhaul, it is currently planned that responsibility for implementation (installation) will be a function of the GWSRP Manager (SEA-62YGD). Although clear lines of changeover from SEA-62Y11G to SEA-62YGD have not been defined, it is expected that SEA-62YGD will plan, organize, and implement waterfront activity to assure that appropriate Fleet liaison is accomplished for both GWSRP-updated and waterfront-updated gun mounts.

6.1.1.2 3"/50 GWSIP Waterfront Support Requirements

In reviewing the planned 3"/50 GWSIP, ARINC Research representatives attended the two semiannual OrdAlt planning conferences at NOSL in November 1979 and March 1980. At these conferences, Naval Sea Support Office (Altantic and Pacific) and TYCOM Staff personnel expressed significant concern about their lack of insight into NAVSEASYSCOM's overall plan for accomplishing waterfront OrdAlt installations (i.e., When will the OrdAlts be available? What activities will be responsible for the installations? How will the ships' forces be indoctrinated regarding operation and maintenance? What are the logistics support plans?) Although these queries were superficially answered, the details of waterfront requirements such as ship schedules, manpower planning, contractor support, COSAL updates, technical support, and ship briefings were not provided.

6.1.2 Other GWSRP-Related Items

In addition to the analysis of 3"/50 GWSIP, two items of special interest to NAVSEASYSCOM were identified because of TYCOM expressions of interest during the GWSRP meeting in March 1980.

6.1.2.1 Waterfront Capabilities to Remove and Install Other Ordnance Material

During discussions of the GWSRP Manager's investigation into waterfront GWS removal and installation capabilities, several requests and proposals were made by TYCOM and SEACEN representatives concerning other ordnance material. Statements from the COMNAVSURFPAC representative indicate that the very problems associated with gun system lifting fixtures (discussed in Chapter Four) are prevalent in missile and surface underseas weapon systems as well. Although the efforts undertaken by SEA-62YG concerning gun systems were favorably endorsed, both COMNAVSURFLANT and COMNAVSURFPAC requested that NAVSEASYSCOM cover the entire upgrading of surface weapon system lifting equipment. Specifically, it was requested that SEA-62YG solicit other equipment managers (e.g., ASROC, Torpedo Tubes, Missile Launchers) to perform a similar inventory, analysis, and stocking of lifting equipments at selected waterfront locations.

6.1.2.2 Equipment Removals to Accommodate Close-In-Weapon System

Another concern of the TYCOMs was their own lack of knowledge of 3"/50 gun mounts that would be removed to provide space for CIWS installations. Of primary concern was whether or not some of the mounts scheduled for the 3"/50 GWSIP would be removed shortly after upgrade to provide deck space for CIWS. Although the queries were not readily answered, NOSL and NAVSEA-62YB assured the TYCOM representatives that there would be appropriate coordination between the two programs before any upgrading took place.

6.1.3 Special Gun Maintenance Issues

To assure appropriate long-range planning of Fleet requirements for Class A overhauled GWSs, ARINC Research performed a special analysis of Fleet requirements for FY 1985 through FY 2000. It was requested that this analysis be prepared in a format appropriate for submittal to NAVSEASYSCOM (SEA-62YGB). This analysis resulted in a position paper that recommended combining several GWSRP efforts with emergent GWS requirements. The position paper is presented in Appendix G.

6.2 CONCLUSIONS AND RECOMMENDATIONS

Conclusions and recommendations formed from GWSRP-related studies (Section 6.1) are presented in the following subsections.

6.2.1 Conclusions

6.2.1.1 3"/50 Gun Weapon System Improvement Program

In view of the extended period (five years) required to accomplish all GWSIP OrdAlt installations at the several waterfront sites, a strong emphasis on installation coordination is necessary to assure proper introduction of the gun mount improvements to forces afloat. Timely and well-planned briefings must be presented to all users and installers to assure that adequate Fleet support is provided by the Material Command.

6.2.1.2 Waterfront Capabilities to Remove and Install Other Ordnance Material

In view of Fleet comments regarding the inadequacies of ordnance lifting equipment in general, it appears appropriate to expand the GWS lifting equipment inventory to include all surface ordnance systems and to determine the status of lifting equipment.

6.2.1.3 Special Gun Maintenance Issues

During the development of the position paper regarding increased Fleet requirements for restored GWSs in the 1985 through 2000 period (see Appendix G), it was concluded that significant realignment of the industrial process at the depot site must be undertaken by 1983, or additional industrial manpower must be assigned to the gun rework effort to increase output capacity.

6.2.2 Recommendations

A FY 1981 effort should be undertaken to establish the criteria for effective support of 3"/50 GWSIP waterfront installation coordination with Fleet activities.

A FY 1981 effort should be undertaken to expand the GWS lifting equipment study to include other surface weapon systems.

APPENDIX A

MCR SUMMARY AND ANALYSIS SHEETS

MCR report results are transmitted by means of summary report sheets, which are tailored to each particular GWS. This appendix contains samples of typical MCR summary sheets and analysis sheets.

NOTE: Material condition rating on Summary Sheet 1 is determined by:

Level 1 - No repairs are required.
Level 2 - All repairs can be made by ship's force.
Level 3 - Repairs require dockside assistance.
Level 4 - Component needs replacement.

5"/54 GUN MOUNT
SUMMARY SHEET 1

SHIP _____ HULL _____ DATE INSPECTED _____

MOUNT POSITION _____ SERIAL NO. _____ MK 42 MOD _____

PROCEDURE NO. & IDENTIFICATION	MATERIAL CONDITION LEVEL				COMPONENT ESL
	1	2	3	4	
1. EP1/EP2 Panels					
2. EP3/EP4/EP5 Panels					
3. Electrical Connection Boxes					
4. Train Power Drive					
5. Elevation Power Drive					
6. Shield Assembly					
7. Carriage/Stand/ Roller Path					
8. Empty Case Ejector/ Empty Case Tray.					
9. Gas Ejector					
10. Breech Mechanism					
11. Rammer					
12. Left/right Transfer Trays					
13. Left/Right Fuze Setters					
14. Left/Right Cradles					
15. Left/Right Upper Hoists					
16. Ammunition Carrier					
17. "C"/"D" Lower Hoists					
18. "A"/"B" Loader Drums					
19. Lower Accumulator System					
19A. Loader Accumulator System (Mod 10 only)					
20. Upper Accumulator System					
21. Time Cycle Tests					
22. Telescope/Sight					
23. Recoil/Counterrecoil/ Slide Area					
24. HP/LP Air System					

5"/54 GUN MOUNT
SUMMARY SHEET 1 (CONTINUED)

SHIP _____ HULL _____ DATE INSPECTED _____

MOUNT POSITION _____ SERIAL NO. _____ MK 42 MOD _____

SYSTEM MATERIAL CONDITION LEVEL (MCL) _____ (CURRENT CONDITION)

SYSTEM-LEVEL EQUIPMENT STATUS (BASED ON ADEQUATE MAINTENANCE, INCLUDING RECOMMENDED SUBASSEMBLY REPAIR/REPLACEMENT). ESTIMATED SERVICE LIFE (ESL) _____

REMARKS:

RECOMMENDED SUBASSEMBLY REPLACEMENT (INCLUDE MK & MOD)

UNIT	FSN	APL

RECOMMENDED NEXT INSPECTION DATE _____

COMPLETED BY _____ DATE _____

5"/54 GUN MOUNT
SUMMARY SHEET 2

SHIP _____ HULL _____ DATE INSPECTED _____

MOUNT POSITION _____ SERIAL NO. _____ MK 42 MOD _____

SUMMARY OF NECESSARY REPAIRS:

COMPLETED BY _____ DATE _____

SHIPS POINT OF CONTACT _____

RANK _____ TITLE _____

ANALYSIS OF MATERIAL CONDITION REVIEW

SHIP _____ HULL NO _____ DATE INSPECTED _____

SYSTEM _____ MK _____ MOD _____ LOC _____ SERIAL NO _____

ERC _____ MCL _____ _____ NAVORDSTA, INDIAN HEAD
(CODE: 5033H)

REMARKS: CST&C # _____

COMPONENT REPLACEMENTS:

CONFIGURATION DISCREPANCY:

MISSING DATA:

APPENDIX B

COMPUTER SOFTWARE DEVELOPMENT AND MANAGEMENT REQUIREMENTS

This appendix presents computer software development and management requirements as set forth in ARINC Research Corporation Technical Perspective Number 25 of January 1976.

SOFTWARE DEVELOPMENT AND MANAGEMENT

The computer software development process is outlined in Figure 1. The illustrated process consists of four phases: Specification, Design, Production, and Computer Program Integration and Testing, as discussed below.

Software Specification

The specification of system requirements is the first phase of software acquisition, and generally entails the following activities:

a. Establish user requirements.

b. Define system requirements.

c. Set functional specifications.

d. Compare alternate configurations:

   1) Hardware/software tradeoffs

   2) Cost, performance, and effectiveness

e. Document and review final system specifications.

The major requirement of this first phase of software development is a comprehensive system specification. The specification should be sufficiently detailed to provide a baseline from which software design and production can proceed without the need for further definition of total system requirements. At that time a high order system simulation can be generated to the baseline specifications to test further the system concept and examine the feasibility of specific user requirements. The process of generating a system simulation from the system specification often identifies ambiguities or omissions in the specifications, and provides as well a means for testing critical aspects of logic, function, procedures, and timing.

The system specifications must include or reference a complete description of the associated computer hardware and all interfacing peripherals. If the software in development is required to interface with existing executive, peripheral control, or other applications software, then this fact must be called out in the system specification, and detailed descriptions given of these interfacing software packages.

If the system is required to access an existing or otherwise separate data base, then procedures and protocol for data exchange should be included in this system specification.

Computer program acceptance test requirements, particular requirements on physical form of machine readable code, and procedures for field changes of the debugged code, should either be referenced or identified in the system specifications.

Software Design

Following the requirements engineering and the system specification effort, software functional requirements are established. The usual approach is:

a. Identify computer hardware and software functional requirements.

b. Define interface transfers.

c. Specify hardware, functional, and data constraints.

d. Define performance and test specifications.

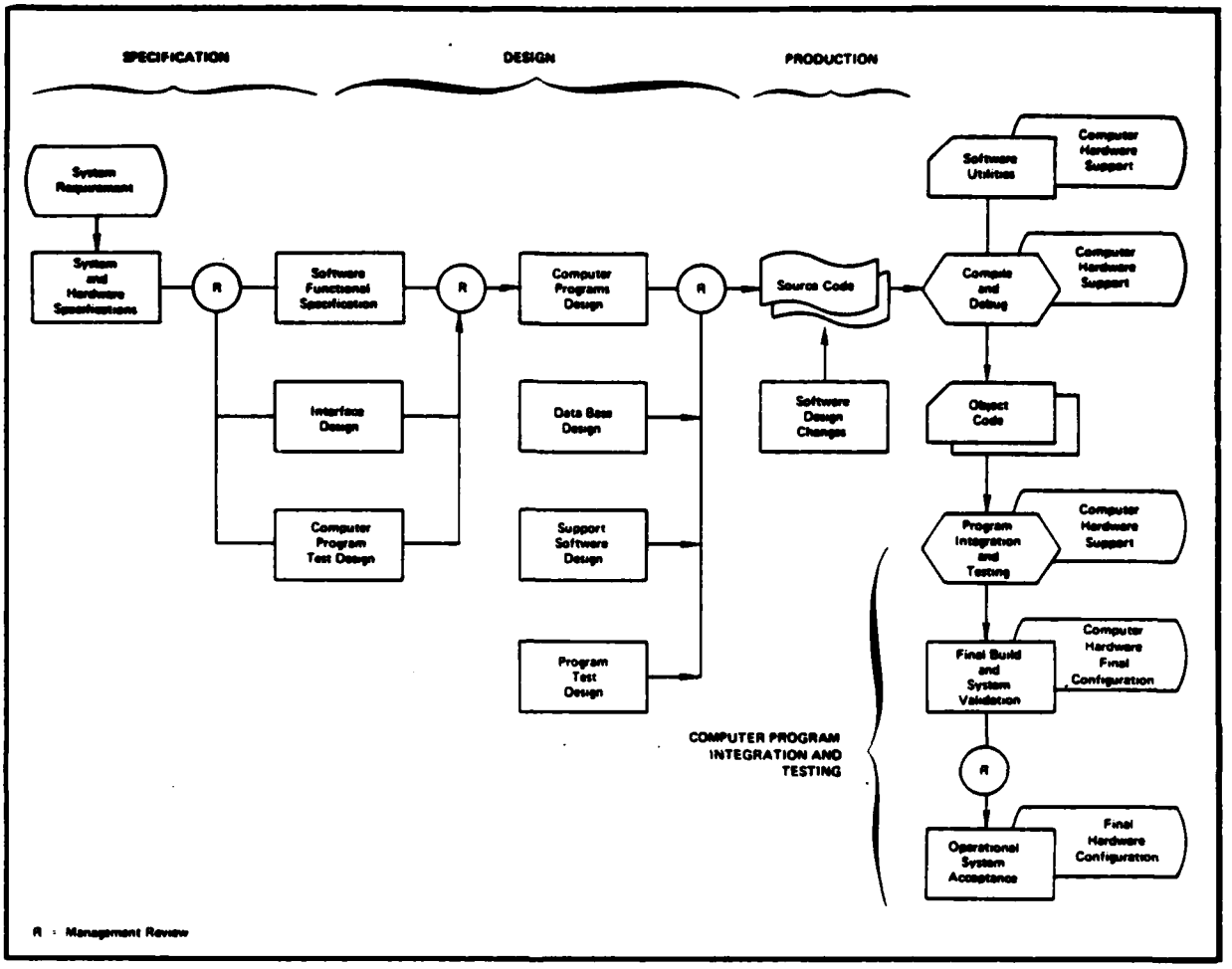


Figure 1. COMPUTER SOFTWARE DEVELOPMENT PROCESS

e. Define software constraints:

   1) Source language and compiler

   2) Operating system and utility programs

   3) Structure and coding restrictions.

f. Specify all delivered items:

   1) System documentation

   2) Operating and training manuals

   3) Support programs and utilities

   4) Machine readable items.

g. Establish management requirements:

   1) Management review and project control plan

   2) Demonstration and delivery schedules

   3) System verification/ validation plan.

The purpose of the software functional specifications is to identify guidelines, conventions, constraints, and specific resolution among various possible software mechanizations of system requirements. The software functional specification provides a baseline for computer software design. This document generally provides an intermediate interpretation of system requirements in the sense that it serves to communicate all system requirements to the software designer. The document also sets software design and production conventions, procedures, and standards, and identifies the software production management plan, including schedules for demonstration and delivery.

Software Production

Before software production is allowed to begin, software functional specifications must be interpreted in terms of computer program designs. This activity provides specific task description documents for the coder, and typically comprises the following tasks:

a. Establish software architecture.

b. Design task, file, and control structures.

c. Set up computer program integration plan.

d. Schedule production, test and integration of all program components.

e. Design support software and test drivers.

f. Establish nomenclature, configuration control, program library procedures, and coding standards.

g. Set up milestones and design review schedules:

   1) System evaluation and simulation reviews

   2) Code production and integration

   3) Demonstration and delivery schedules.

h. Identify applicable Mil standards and other standards.

Integration and Testing

Four additional software engineering activities supporting the development effort are the QA function, compliance management, maintenance planning, and installation and demonstration testing. These activities are briefly categorized by associated tasks in Table 1.

The QA and compliance management activities are directed toward assuring that the completed software will meet established requirements. Installation and demonstration testing have as the common objective the determination that the software is ready for field deployment. Maintenance planning provides for needed programming support to accommodate errors discovered after the system is operational, or to implement operational changes.

Table 1. SOFTWARE ENGINEERING SUPPORT ACTIVITY

A. Software Quality Assurance

1) Devise QA plan.

2) Review coding standards and procedures.

3) Participate in design review.

4) Monitor production for conformance with specifications.

5) Assist in test planning.

6) Monitor testing.

7) Report test results.

8) Identify and report deviations.

9) Review documentation.

10) Certify deliverable items.

B. Software Compliance Management

1) Monitor:

   a. Conformance to design specifications

   b. Delivery to schedule and cost

   c. Performance to specifications.

2) Review and evaluate:

   a. Modularity and expandability

   b. Capability for design change

   c. Maintainability

   d. Documentation

   e. Training requirements

   f. Warranty provisions.

C. Software Maintenance Planning

1) Define maintenance organization.

2) Establish configuration control plan.

3) Establish maintenance staffing plan.

4) Identify support software and utilities.

5) Identify computer hardware facilities.

D. Installation, Demonstration and Testing

1) Schedule startup and demonstration test plans.

2) Define detailed test procedures.

3) Specify facilities requirements.

4) Schedule backup tests and failure contingencies.

5) Monitor or conduct tests and evaluate results.

APPENDIX C

INVENTORY OF GWSRP COGNIZANT EQUIPMENT
LIFTING GEAR

Waterfront facilities that have responded to the joint NOSIH and ARINC Research inventory request are listed in Table C-1. Information is given on type and number of lifting rigs, together with certification, usage, and material condition of the rigs themselves.

Table C-1. INVENTORY OF GMSRP-RELATED EQUIPMENT LIFTING GEAR

Organization	Gun Mount Lifting Fixtures			Gun Director	Serial Number	Date Last Certified	Date Last Used	General Condition of Fixture	Remarks	Sets of Pads			
										5"38		5"54	
	3"50	5"38	5"54							Mk 30	Mk 38	Mod 9	Mod 10
Naval Shipyards													
1. Charleston	(1) Mk 27/33					5/9/78	Unknown	Good	(SK225011-1-F)MGF1	-	-	-	-
		(1) Mk 37/30				3/70	Unknown	Fair	Utilized for Mk 37 Director also				
			(1) Mk 42			8/29/79	1979	Good	Utilized for 5"38 Mk 38 also				
	(1) Loader					None	Unknown	Poor	(511653-1-A)MGF28				
2. Norfolk	(1) Mk 27/33					None	Unknown	Fair	Unmodified rig	1	1	1	1
		(1)Mk 30				None	Unknown	Fair	FSN 2A-1020-00-162-4974				
		(1)Mk 38				None	Unknown	Fair	FSN 2A-1020-00-707-2343				
			(1)Mk 42			None	3/79	Fair	Dwg #733519				
				(1)Mk 56		None	Unknown	Good					
3. Long Beach	Utilize "in-house" rigging from riggers shop					-	-	-		-	-	-	-
4. Mare Island	(1)Mk 38 (enclosed)					None	1965	-	Locally assembled	1	1	-	-
	(1)Mk 38 (open)					None	1965	-	Locally assembled				
5. San Diego	Utilize rigs from SIMA San Diego when requirement arises					-	-	-		-	-	-	-
6. Philadelphia			(1)Mk 42			None	4/80	Good	Dwg #733519	-	-	-	3
7. Pearl Harbor	(1)Mk 33					None	-	Good	3"50 rig not modified for shielded mount use	1	1	1	1
8. Puget	(1)Mk 33					1979	1979	Good	Manufactured by NOSL	1	1	1	1
		(1)Mk 30				1979	1979	Good	Manufactured by NOSL				
		(1)Mk 38				1979	1979	Good	Manufactured by NOSL				
			(1)Mk 42			1979	1979	Good	Manufactured by NOSL				
SIMAs													
1. Norfolk	(1) Mk 27/33					5/24/77	8/79	Good	(SK225011-1-D)	-	1	-	-
2. Little Creek	(1) Mk 27/33					None	9/28/79	Good	Locally assembled	-	-	-	-
3. San Diego	(1) Mk 27/33					10/78	7/79	Good	Modified rig	-	-	1	1
		(1)Mk 38				10/78	4/79	Good	Locally assembled				
			(1)Mk 42			10/78	3/79	Good	Locally assembled				
4. Pearl Harbor	No requirements/capability to lift					-	-	-		-	-	-	-
5. Charleston	No capability to lift									-	-	-	-
6. Mayport	Utilize "in-house" rigging from riggers shop					-	-	-		-	-	-	-
SUPSHIPs													
1. Pascagoula			(1)Mk 45		USN 00675	N/A	Never used	Good	Lifting Frame Dwg #2532575				
			(2)Mk 45 (Loaders)		USN 00482/00655	N/A	8/79-9/79	Good	Loader Hndlg Fixture Dwg #2527316				
			(2)Mk 45		USN 00316/00315	N/A	9/79-Never used	Good	Loader Hndlg Fixture Dwg #2527319				
			(1)Mk 45		USN 00656	N/A	9/79	Good	Sling & Beam Dwg #2527319				
2. Charleston	No requirements/capability to lift					-	-	-					
3. San Diego	No requirements/capability to lift					-	-	-					
4. Portsmouth, VA	Utilize rigs from NNSY or NAVSEACEN when requirement arises					-	-	-					
NOSL													
1. Louisville	(3) Mk 27/33					-	-	2 good/ 1 not used	Mount rigs continuously used	-	-	1	1
		(2)Mk 38				-	-	Good	Semiannual tests conducted				
			(2)Mk 42			-	-	Good					
			(1)Mk 45			-	-	Good					
			(1)Mk 75			-	-	Good					
Totals	(10) Mk 27/33 (1) (Loader)	(3) Mk 37/30 (7)Mk 38	(7)Mk 42 (5)Mk 45 (1)Mk 75	(1)Mk 56						4	5	5	10

APPENDIX D

PUBLICATION REFERENCES

The following technical manuals and publications were used as references for the GWSs Lifting Gear Capability Analysis:

1. NAVSEA OP 1810, Revision 1, *Ordnance Equipment Handling and Shipping Instructions,* 1 February 1978.

2. NAVSEA OP 4343 Volume 3, Change 1, Preliminary Technical Manual, *76mm/62 Caliber Gun Mount Mark 75 Mods 0 and 1 Installation/ Installation Checkout,* 1 July 1974, changed 15 August 1978.

3. NAVORD OP 3644, Mk 68 Fun Fire Control System.

4. Fleet Allocations through 1988 of Surface Warfare Gun Fire Control Systems, 1 March 1980.

5. NAVSEA Notice 8023, of 30 August 1979; Ordnance Lifting Equipment-Periodic Tests of.

6. NAVORDSTA, Louisville, Kentucky, Message of 201955Z October 1978; 3"/50 Caliber Gun Mount Lifting Fixtures.

APPENDIX E

LIFTING GEAR EQUIPMENT REQUIREMENTS

Table E-1 lists the required equipment for each unique set of GWS lifting gear.

Table E-1. LIFTING EQUIPMENT REQUIREMENTS

Mount/Director Type	Lifting Equipment	Drawing Number	Quantity (each)
3"/50 Caliber Gun Mount, Mk 33 (twin mount)	Lifting Beam	Sk. 225011-39	1
	Strap	252288-5	4
	Shackle	511605-1	2
	Shackle	511607-2	2
3"/50 Caliber Gun Mount (single mount or oscillating assembly)	Lifting Beam	511691	1
	Crane to Beam Rig	511654-7	1
	Sling	511654-3	2
	Sling	511654-4	1
	Barrel Ring	511654-5	1
	Support Bar	511653-2	1
5"/38 Caliber, Mk 38 (twin mount)	Lifting Beam	230872-1	1
	Sling Rope	230871-2	4
	Sling Bracket (front)	251067-2	2
	Sling Bracket (rear)	251067-1	2
	Bolt	251067-4	24
	Nut	12-Z-9-8	24
	Sling Rope (for optional rig)	230871-1	2
	Shackle (1)	181707-3	2
	Shackle and Pin (1)	64083-1,2	1
5"/38 Caliber, Mk 30 (single mount)	Lifting Beam (Type I)	180793	1
	Lifting Lug	Sk. 79652-1	1
	Pin	Sk. 79652-2	1
	(Pin) Keeper	Sk. 79652-3	1
	Lifting Lug (front)	236208-2	2
	Lifting Lug (rear)	236208-1	2
	Bolt (front Lug)	Z43-B-18850-200	8
	Bolt (rear Lug)	Z43-B-18850-194	8
	Sling (for open mount)	180795	4
5"/54 Caliber, Mk 42	Lifting Beam	733519	1
	Spreader Bar	1339718-1	2
	Lifting Pad (Mod 10)	2873007	4
	Lifting Pad (Mod 9)	2594613	4
	Capscrew (upper) (Mod 10)	1611209-209	8
	Bolt (lower) (Mod 10)	1368216-1	8
	Nut (Mod 10)	2533408-129	8
	Shim Plates (Mod 10)	733518-1,2,3	as required
	Capscrew (Mod 9)	1611209-256	16
	Sling	730449-1	4
	Shackle	1339718-1	8
	Clevis	730449-2	4
	Loader Lifting Device	730424	1
	Carrier Lifting Plate	SA 2814019	1
5"/54 Caliber, Mk 45	Mount Shipping Fixtures	2530784	1
	Mount Lifting Fixture	2527319	1
	Barrel Lifting Fixture, Mk 21 Mod 0, Loader Drum Assembly	2642626	1
	Lifting Fixture	2527316	1
76mm Mk 75	Mount Shipping Fixture	1376-97-112*	1
	Mount Lifting Fixture	1376-97-108*	1
	Transport Base	4276-14-100/01*	1
	Mount Foundation Drilling Fixture	4276-14-100/04	1
Director, Mk 68	Strong Backlift	1332821	1
	Center Beam**	Sk. 409349	1
	Lifting Lug**	Sk. 409351-1	1
	End Beam**	Sk. 409350-2	2
	Sling Assembly	Sk. 409351-5	4

*OTO - MELARA drawing number.
**To be used in lieu of strong backlift.

APPENDIX F

DDEOC GWS-RELATED CMP ITEMS
AND NOTIONAL MAINTENANCE SCHEDULE

Tables F-1 through F-4 identify engineered and qualified CMP tasks (with their respective man-hours and periodicity) for the FF-1052, DDG-37, CG-26, and DD-963 Ship Classes, respectively. Figure F-1 is a DDEOC notional maintenance schedule for those CMP tasks.

Table F-1. FF-1052 CLASS GWS-RELATED CMP ITEMS

DDEOC Task Number	Task Description	Total Task Man-Hours	Task Frequency (Months)
	Engineered Tasks		
E4811-01	Exchange or Class B overhaul Mk 68 Gun Director, including Mk 7 Slip Ring Assembly, Mk 76 Amplifier, and Mk 146 Control Panel	1,176	60
E4811-02	Accomplish Class B overhaul of Mk 16 Mod 2 Stable Element, including Mk 156 Control Panel and Mk 36 Rate Transmitter.	976	60
E4811-03	Perform Class B overhaul of Mk 47 Computer	880	60
E4811-04	Accomplish Class B overhaul of AN/SPG-53( ) Radar Set, including the Radar Signal Processing Equipment (does not include Mk 38 Mod 0 Antenna Scanner)	1,688	60
E4811-05	Accomplish overhaul of Mk 68 Gun Director Amplidynes and Motor Generators	300	36
E4811-06	Replace the Mk 16 Mod 2 Stable Element, including the Mk 156 Control Panel and Mk 36 Rate Transmitter, with a refurbished unit	250	120
E4811-07	Replace Mk 47 Computer with a refurbished unit.	250	120
E4811-08	Replace AN/SPG-53 Radar, including the Radar Signal Processing Equipment, with a refurbished unit (does not include the Mk 38 Antenna Scanner)	250	120
E4811-09	Replace the AN/SPG-53 Radar Set Antenna Scanner Mk 38 Mod 0 with a refurbished unit	24	60
E7111-01	Accomplish star gauge measurement of 5"/54 Gun Barrel	16	12
E7111-02	Accomplish Class B overhaul of the 5"/54 Gun Mount, Mk 42 Mod 9 or mount turnaround at NOSL	18,800	144
E7111-03	Regas, seal, and align the Mk 116 Mod 0 or Mk 102 Mod 6 Telescope	32	24
E7111-04	Replace the Shield Assembly, Mk 61 Mod 10 Flexible Shafts	48	60
	Qualified Tasks		
Q4811-01	Accomplish Class C repairs to the Mk 16 Mod 2 Stable Element as indicated by POT&I results and ship's CSMP; include Mk 156 Mod 2 Control Panel and Mk 36 Mod 2 Rate Transmitter	145	184
Q4811-02	Accomplish Class C repairs to the Mk 47 Mod 10/11 Computer as indicated by POT&I results and ship's CSMP	30	184
Q4811-03	Accomplish Class C repairs to the Mk 68 Mod 3 Director, as indicated by POT&I results and ship's CSMP.	335	184
Q4811-04	Accomplish Class C repairs to various units of the AN/SPG-53( ) Radar Set and Radar Signal Processing Equipment as indicated by POT&I results and ship's CSMP.	145	184
Q4811-05	Accomplish Class C repairs to the Mk 14 Mod 6 or 13 GFC Switchboard as indicated by POT&I results and ship's CSMP.	15	184
Q7111-01	Accomplish repairs to 5"/54 Mk 42 Mod 9 Gun Mount including Shield Assembly as indicated by POT&I results and ship's CSMP.	2,400	60
Q7111-02	Accomplish Class C repairs on 5"/54 Mk 42 Mod 9 Gun Mount as indicated by POT&I results and ship's CSMP.	480	SRA
Q7111-03	Accomplish repairs to 5"/54 Mk 42 Mod 9 Gun Mount as indicated by POT&I results and ship's CSMP.	450	18
Q7111-04	Remove and replace gun barrel liner or monoblock barrel upon star gauge reports and bore erosion readings.	48	48

Table F-2. DDG-37 CLASS GWS-RELATED CMP ITEMS

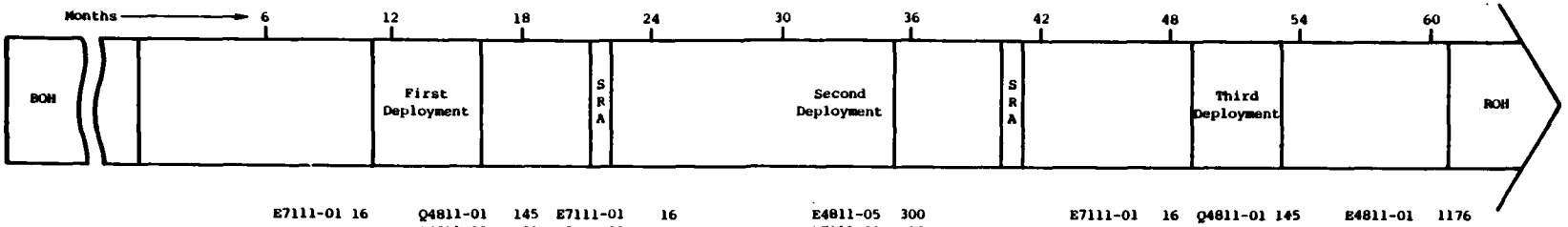
DDEOC Task Number	Task Description	Total Task Man-Hours	Task Frequency (Months)
	Engineered Tasks		
E4811-01	Replace Mk 62 Gun Director including the Mk 7 Slip Ring Assembly, Mk 76 Amplifier, and Mk 146 Control Panel with a refurbished unit.	1,176	60
E4811-02	Accomplish Class B overhaul of Mk 16 Mod 1 Stable Element, including Mk 156 Control Panel and Mk 36 Mod 2 Rate Transmitter.	976	60
E4811-03	Accomplish Class B overhaul of Mk 47 Mod 7 GFCS Computer including Mk 116 Starshell Computer.	3,088	60
E4811-04	Accomplish Class B overhaul of AN/SPG-53( ) Radar Set with RSPE and Exchange Antenna with a refurbished unit.	2,240	60
E4811-05	Accomplish overhaul of the Mk 68 Gun Director Amplidynes and Associated Drive Motor.	300	36
E4811-06	Accomplish Class B overhaul of Mk 41( ) or Mk 75 Mod 1, Rangefinder, including Mk 100 Mod 1 Telescope.	560	60
E4811-07	Replace the Mk 46 Mod 1 Stable Element, including Mk 156 Mod 1 or 2 rate transmitter with a refurbished unit.	250	120
E4811-08	Replace Mk 47 Mod 7 Computer with a refurbished unit.	250	120
E4811-09	Replace AN/SPG-53( ) Radar Set including antenna and RSPE (Radar Signal Processing Equipment) with refurbished unit.	250	120
E7111-01	Accomplish Star Gauge Measurements of the 5"/54 Gun Barrel.	16	12
E7111-02	Accomplish Class B overhaul of 5"/54 Mk 42 Mod 10 Gun Mount or Mount Turnaround at NOSL.	18,800	120
E7111-03	Replace the Shield Assembly Mk 61 Mod 11 Flexible Shafts.	48	60
E7111-04	Regas, seal, and align the Mk 116 Mod 0 or Mk 102 Mod 6 Telescope.	32	24
	Qualified Tasks		
Q4811-01	Accomplish Class C repairs to Mk 16 Mod 1 Stable Element as indicated by POT&I and ship's CSMP. Include Mk 156 Mod 1 or 2 Control Panel and Mk 36 Mods 1/2 Rate Transmitter.	145	18
Q4811-02	Accomplish Class C repairs to Mk 47 Mod 7 GFCS Computer and associated Mk 116 Mod 0 Starshell Computer as indicated by POT&I results and ship's CSMP.	30	18
Q4811-03	Accomplish Class C repairs to the Mk 68 Mod ( ) Gun Director as indicated by POT&I results and ship's CSMP.	335	18
Q4811-04	Accomplish Class C repair to various units of the AN/SPG-53( ) Radar Set and RSPE as indicated by POT&I results and ship's CSMP.	145	18
Q4811-05	Accomplish Class C repairs to the Mk 14 Mod ( ) GFC Switchboard as indicated by POT&I results and ship's CSMP.	15	18
Q7111-01	Accomplish Class C repairs to the 5"/54 Mk 42 Mod 10 Gun Mount as necessary to correct discrepancies identified by pre-ROH tests and inspections and CSMP.	2,400	60
Q7111-02	Accomplish Class C repairs on the 5"/54 Mk 42 Mod 10 Gun Mount to correct deficiencies identified by prearrival inspection and CSMP.	480	SRA
Q7111-03	Accomplish Class C repairs to the 5"/54 Mk 42 Mod 10 Gun Mount as necessary to correct deficiencies identified by prearrival inspection and CSMP.	450	18
Q7111-04	Remove and replace gun barrel liner or monoblock barrel upon star gauge reports and bore erosion gauge readings.	48	48

Table F-3. CG-26 CLASS GWS-RELATED CMP ITEMS

DDEOC Task Number	Task Description	Total Task Man-Hours	Task Frequency (Months)
	Engineered Tasks		
E4811-01	Check radar optical alignment of the AN/SPG-53( ) radar and adjust as necessary.	4	6
E4811-02	Verify beacon operation of the AN/SPG-53( ) radar and adjust as necessary.	4	6
E4811-03	Test AEI alignment for AN/SPG-53( ) radar and adjust as necessary.	4	6
E4811-04	Accomplish Class B overhaul of AN/SPG-53( ) Radar Set (to include Mk 1 Mod 1 RSPE when installed).	2,024	60
E4811-05	Replace Mk 68 Gun Director including the Mk 7 Slip Ring Assembly, Mk 76 Amplifier, and Mk 146 Control Panel with a refurbished unit.	1,176	60
E4811-06	Accomplish Class B overhaul of Mk 16 Mod 2 Stable Element to include Mk 156 Control Panel and Mk 36 Rate Transmitter.	976	60
E4811-07	Accomplish Class B overhaul of the Mk 47 GFCS Computer.	880	60
E4811-08	Replace Mk 47 computer with a refurbished unit.	250	120
E4811-09	Replace AN/SPG-53( ) Radar (including the Mk 6 Mod 1 RSPE when installed) with a refurbished unit.	250	120
E4811-10	Replace the Mk 16 Mod 2 Stable Element including the Mk 156 Control Panel and Mk 36 Rate Transmitter with a refurbished unit.	250	120
E7111-01	Accomplish Star Gauge Measurement of 5"/54 Mk 42 Mod 10 Gun Barrel Mk 18 (all mods).	12	12
E7111-02	Exchange or accomplish Class B overhaul of the 5"/54 Gun Mount, Mk 42 Mod 10.	18,800	120
E7111-03	Regas, seal, and align the Mk 116 Mod 0 Telescope.	32	24
E7111-04	Replace the shield assembly Mk 61 Mod 11 Flexible Shafts.	24	60
	Qualified Tasks		
Q4811-01	Accomplish Class C repairs to Mk 47 Mod 9 computer to include the Mk 116 Mod 4 computer as indicated by POT&I results and ship's CSMP.	30	18
Q4811-02	Accomplish Class C repairs to Mk 16 Mod 1 Stable Element as indicated by POT&I results and ship's CSMP.	144	18
Q4811-03	Accomplish Class C repairs to the Mk 68 Mod ( ) Gun Director as indicated by POT&I results and ship's CSMP.	335	18
Q4811-04	Accomplish Class C repairs to various units of the AN/SPG-53( ) Radar Set and RSPE as indicated by POT&I results and ship's CSMP.	145	18
Q4811-05	Accomplish Class C repairs to the Mk 14 Mod ( ) GFC Switchboard as indicated by POT&I results and ship's CSMP.	15	18
Q7111-01	Accomplish repairs or overhaul the 5"/54 Mk 42 Mod 10 Gun Mount as indicated by POT&I results and ship's CSMP.	2,400	60
Q7111-02	Accomplish Class C repairs on the 5"/54 Mk 42 Mod 10 Gun Mount as indicated by POT&I results and ship's CSMP.	480	20
Q7111-03	Remove and replace gun barrel liner of monoblock barrel upon star-gauge results and bore erosion gauge readings.	48	48

Table F-4. DD-963 CLASS GWS-RELATED CMP ITEMS

DDEOC Task Number	Task Description	Total Task Man-Hours	Task Frequency (Months)
	Engineered Tasks		
E7111-01	Accomplish star gauge measurement of Mk 45 Mod 0 Gun Barrel as specified by NAVSEAINST 5000.2A.	16	12
	Qualified Tasks		
Q4811-01	Accomplish Class C repairs to various units of the Mk 86 Mod 3 Gun Fire Control System as indicated by ship's CSMP.	250	20
Q4811-02	Accomplish Class C repairs to the Mk 24 target designation transmitter and Mk 79 control unit in accordance with POT&I results or CSMP.	220	20
Q7111-01	Accomplish repairs to Mk 45 Mod 0 Gun in accordance with Material Condition Review, POT&I, and CSMP.	4,800	60



FF-1052			E7111-01	16	Q4811-01	145	E7111-01	16	E4811-05	300			E7111-01	16	Q4811-01	145	E4811-01	1176
					Q4811-02	30	E7111-03	32	E7111-01	16			E7111-03	32	Q4811-02	30	E4811-02	976
					Q4811-03	335			Q4811-01	145			Q7111-04	48	Q4811-03	335	E4811-03	880
					Q4811-04	145			Q4811-02	30					Q4811-04	145	E4811-04	1688
					Q4811-05	15			Q4811-03	335					Q4811-06	15	E4811-09	24
					Q7111-03	450			Q4811-04	145					Q7111-03	450	E7111-01	16
							Q7111-02	480	Q4811-05	15							E7111-04	48
									Q7111-03	450							Q7111-01	2400
											Q7111-02	480						
DDG-37			E7111-01	16	Q4811-01	145	E7111-01	16	E4811-05	300			E7111-01	16	Q4811-01	145	E4811-01	1176
					Q4811-02	30	E7111-04	32	E7111-01	16			E7111-04	32	Q4811-02	30	E4811-02	976
					Q4811-03	335			Q4811-01	145			Q7111-04	48	Q4811-03	335	E4811-03	3088
					Q4811-04	145			Q4811-02	30					Q4811-04	145	E4811-04	2240
					Q4611-05	15			Q4811-03	335					Q4811-05	15	E7111-01	16
					Q7111-03	450			Q4811-04	145					Q7111-03	450	E7111-03	
							Q7111-02	480	Q4811-05	15							Q7111-01	2400
											Q7111-02	480						
CG-26	E4811-01	4	E4811-01	4	E4811-01	4	E4811-01	4	E4811-01	4	E4811-01	4	E4811-01	4	E4811-01	4	E4811-01	4
	E4811-02	4	E4811-02	4	E4811-02	4	E4811-02	4	E4811-02	4	E4811-02	4	E4811-02	4	E4811-02	4	E4811-02	4
	E4811-03	4	E4811-03	4	E4811-03	4	E4811-03	4	E4811-03	4	E4811-03	4	E4811-03	4	E4811-03	4	E4811-03	4
			E7111-01	12	Q4811-01	30	E7111-01	12	E7111-01	12			E7111-01	12	Q4811-01	30	E4811-04	2024
					Q4811-02	144	E7111-03	32	Q4811-01	30			E7111-03	32	Q4811-02	144	E4811-05	1176
					Q4811-03	335			Q4811-02	144			Q7111-03	48	Q4811-03	335	E4811-06	976
					Q4811-04	145			Q4811-03	335					Q4811-04	145	E4811-07	880
					Q4811-05	15			Q4811-04	145					Q4811-05	15	E7111-01	12
					Q7111-02	480			Q4811-05	15							E7111-04	24
									Q7111-02	480							Q7111-01	2400
																	Q7111-02	480
DD-963			E7111-01	16	Q4811-01	250			E7111-01	16			E7111-01	16			E7111-01	16
					Q4811-02	220											Q4811-01	250
							E7111-01	16			Q4811-01	250					Q4811-02	220
											Q4811-02	220					E7111-01	4800

Figure F-1. EOC MAINTENANCE SCENARIO: SUMMARY OF GWS-RELATED CMP TASKS

APPENDIX G

POSITION PAPER ON GWS OVERHAUL REQUIREMENTS

This appendix is a reproduction of the position paper submitted to NAVSEASYSCOM (SEA-62YGB), "FY 1982 - FY 2000 Gun Weapon Systems Overhaul Requirements."

POSITION PAPER

TITLE: FY 1982 - FY 2000 GUN WEAPON SYSTEMS OVERHAUL REQUIREMENTS

ISSUE: ESTABLISHED GUN WEAPON SYSTEMS RESTORATION PROGRAMS WILL NOT FULFILL FLEET REQUIREMENTS FOR CLASS A OVERHAULED EQUIPMENTS DURING THE PERIOD FY 1985 - FY 2000.

PURPOSE: This paper presents a methodology wherein consolidation of the depot overhaul program with a battle spares maintenance program can avoid deficiencies of Class A restored systems and emergent replacement equipments over the next twenty years. Maintaining the operational readiness of the $3 Billion-plus in-service gun weapon systems inventory can be accomplished by an expenditure of less than 1/2 percent of the invested cost.

BACKGROUND: For approximately twenty years, Fleet requirements for completely restored gun weapon systems have been fulfilled by accomplishment of Class A depot-level overhauls at various industrial locations other than shipyards, e.g., NOS, Louisville/NWSC, Crane/Northern Ordnance/etc. These Class A overhauls have been funded by NAVSEASYSCOM and its predecessor NAVORDSYSCOM. The programs was instituted to improve Fleet posture by replacing seriously degraded gun systems of the 1940-50 vintage through the use of an idle inventory of new-condition gun systems held by NAVORDSYSCOM. The removed gun mounts (those not in scrap-condition) were then inducted at the depot overhaul facilities for restoration and return to repository. Through the years, the initial program has grown to include gun fire control equipments as well as gun mounts; the product has been used to complement normal Fleet-funded Class B and C overhaul efforts. The program in being is known as the Gun Weapon System Replacement Program (GWSRP).

From the mid-1950s through the mid-1960s, the Fleet transitioned into a significantly more complex/sophisticated armaments profile by acquisition of the 5"/54 Mk 42 gun mount and Fire Control System Mk 68. The acquisition of these newer systems did not include excess equipments (such as those available in earlier systems) that could support depot-pipeline or catastrophic damage replacement requirements. The more complex systems have also extended industrial overhaul times which further aggravates the problem of no pipeline assets; and in combining these two situations, this very important Fleet restoration program has become a situation where gun systems must be removed before overhaul, expedited through the industrial cycle, and returned to the Fleet unit from which it was removed.

Through FY 1980 there have been about fifteen Class A restorations of the 5"/54 Mk 42 gun systems. While intensive Fleet and NAVSEASYSCOM Management has precluded ship overhaul delays with the ship-to-shop approach with a limited number of equipments (about 10 per year), Fleet requirements during 1985-2000 of approximately 30 overhauls per year demand improvements to the GWSRP process if the necessary armaments posture is to be maintained.

DISCUSSION: Although the impact of maintaining this highly effective gun weapon system restoration program with the complex weapon systems in the Fleet today should have surfaced about 10-12 years after the systems were installed, the problems have been circumvented thus far. Among the reasons are: During the early years of 5"/54 Mk 42 Mod 0-8 installations (1955-65) there was minimal usage of the equipment and therefore Class B overhauls and organizational maintenance programs proved adequate to prevent serious deterioration; organizational manning was significantly higher, both quantitative/qualitative, during the 1955-65 period because the Mk 42 guns were installed in new construction ships wherein manning was more stable and nearer allowance requirements; and, most importantly, at the time when the Mk 42 Mod 0-8 guns would show serious deterioration (about 1968-70) the 5"/54 Mk 42 Mod 10 Conversion Program, which included a major Class A restoration as well as significant design upgrade, was accomplished. Basically then, during the period 1969-1975, the Fleet was outfitted with forty-five (45) new Mk 42 Mod 9 gun systems in the FF-1052 Class and eighty-nine (89) restored/upgraded Mk 42 Mod 10 gun systems in CG/DD/DDG/FF classes. From 1975-80, an additional seventy-nine (79) 5"/54 Mk 45 gun systems have been installed in DD/CGN/LHA classes for a total 5"/54 population of almost two-hundred thirty (230) that includes fifteen (15) Mk 42 Mod 7 gun systems in DD-931 Class; Tab A illustrates these gun system locations.

Presently, Mk 42 Mods 7 and 9 gun systems are being restored at NOS, Louisville and the Mk 42 Mod 10s are scheduled for induction to GWSRP in FY 1982. The Mk 45 Mod 0 program is scheduled to commence overhaul in FY 1983. In addition to the 5"/54 items, the 76MM Mk 75 (OTO Melara) restoration program will commence in FY 1986-87 and the 3"/50 Mk 33 effort is projected to run through 1995. With the exception of 3"/50, the gun systems covered under the Class A restoration program require about 6 calendar months at the industrial facility for teardown, refurbishment, ORDALT installation, reassembly and check-out.

Based on an average of eleven years between Class A overhauls, the workload projected for FY 1987 and annually thereafter is 9 percent or twenty-one (21) 5"/54 gun mounts. Using the same criteria to analyze the workload for 76MM gun systems (although it is presently estimated that more frequent restoration may be required), the seventy-four (74) gun mounts will cause an additional seven (7) Class A restorations per annum. The total gun system workload at Louisville for the newer mounts will be about 28/year in FY 1987 while the current workload (less 3"/50) is only 10 systems/year.

A variation of the present (FY 1980) and projected (FY 1987) industrial workload must be made in man-year requirements. Based on FY 1980 productivity and manufacturing process, the 5"/54 Mk 42 Mods 7 and 9 require an average of 25,500 man-hours or about 12 man-years/system or about 120 man-years. If the same industrial process is applied in FY 1987, almost 300 industrial billets are required at NOS, Louisville for 5" and 76MM mounts alone. The current and projected 3"/50 overhaul programs at Louisville requires an additional 35-40 man-years for a grand total of 340 billets necessarily involved in gun system Class A restoration in FY 1987.

A very similar situation can be illustrated in the case of gun-fire control systems in the outyears. In past years the steady reduction in ship population made large quantities of older systems (Mk 37, 56, and 63) available for restoration to meet Fleet requirements before there was an actual demand. As with the Fleet's transition to 5"/54 gun systems, when the newer fire-control systems were introduced (Mk 68 and 86), there were no excess equipments made available for depot pipeline or catastrophic damage requirements. Although it has been envisioned that some FCS Mk 68 systems would become available to overcome present shortages in the depot

overhaul program through DDG Class conversions from Mk 68 to Mk 86, changes to modernization program plans indicate this solution cannot be anticipated in the near-term.

In addition to the strain on the GWSRP attributable to more complex systems requiring additional rework-cycle-time, changes to ship overhaul programs pose different, but similar, constraints to management. With a shift of many regular overhauls of combatants from organic to private shipyards, much of the previously accomplished Class B overhaul work at Navy shipyards has migrated to the Class A restoration programs. This is because the private yards do not have adequate combat system rework teams and much of Class B overhaul work is the result of "open and inspect"; work which cannot be specified in a contract prior to commencement of overhaul. Consequently, many of the Class A reconditioned items are now sent to private shipyards for installation and check-out. The involvement of private shipyards and contractual specifications for GFE (restored gun weapon systems) removes all latitude available to the NAVSEASYSCOM GWSRP Manager, as well as to Type Commanders, to modify overhaul schedules at the depot when unforeseen problems arise. (I.e., in the past when a mount undergoing Class A restoration was more urgently required by a unit not scheduled for a reworked system, the equipment would be diverted to the more pressing requirement and other appropriate overhaul plans could be initiated for the unit originally scheduled for the Class A restored item. Now, when a unit enters private yard, the GWSRP scheduled equipment has generally already been removed and shipped to Louisville, and the contract for the private yard ROH requires specified dockside due dates of the missing equipment to accomplish specified check-outs and trials. Failure to deliver the equipment necessitates extended overhauls and the concomitant cost overruns).

In the foregoing it would seem that a reasonably adequate rotable pool/ battle-spares inventory of total systems would provide partial solution to the problems caused by unforeseen catastrophic equipment damage, transportation delays, ship-overhaul schedule changes, lack of long-lead materials, lack of industrial work force, and the frequent O&M,N budget reprogrammings. Unfortunately, battle spare inventories generally suffer from long periods of idleness and the usual result in that the equipment requires significant repair to deteriorated components before it can be utilized; the equipment has become cannibalized; or, the spare equipment configuration requires significant ORDALT upgrade before it can be integrated with other equipments of the ship's installed system. Therefore, using up battle spares if available, is not a long-term solution to depot-overhaul program deficiencies; and, when catastrophic replacements have been required in the past, significant disruption is caused in the GWSRP overhaul schedule.

A significantly more viable Gun Weapons Systems Replacement Program must evolve during the next 3-5 years to meet known and vitally needed Fleet requirements, simply because Class B and C overhauls and organizational maintenance strategies of the 1985-2000 time frame cannot keep-up with known gun weapon system deterioration problems. As has been shown, current gun weapon system Class A restoration processes (coupled with limited man-power and known facility restrictions) cannot accommodate the additional workload projected for the FY 1986-87 time frame. Experience and history also indicate that attempts to program and budget for spare systems have had limited success, although NAVSEASYSCOM has had some success in accumulating major components utilizing the WPN budget line.

For example, during the past 2-3 years, NAVSEASYSCOM has attempted to preclude some of the forthcoming problems through early procurement of 2J Cog major assemblies in support of 5"/54 gun systems overhaul utilizing the WPN budget line. Similar attempts have been made to budget for major fire-control system assemblies through the OPN line, with minimal success.

In spite of these early procurement efforts, and even though the major components are procured for use in the Gun Weapons Systems Replacement Program, once the assemblies are acquired inventory control passes to SPCC and issue of piece-parts (6U Cog items) commonly occurs to fill CASREPT requirements. This random issuance of piece-parts from major components has frequently disrupted orderly amassing of enough components to plan build-up of a major system section.

The limited successes in obtaining depot pipeline and castrophic failure assets does not negate the requirement however, and some additional measures are urgently required. Shortening equipment removal and transportation times further would not reduce the total overhaul cycle time markedly, or would it provide the "extra" assets necessary to correct for inventory losses (major casualties). The real problem area, and the only area that lends itself to time-compression improvement, is the actual industrial cycle -- teardown to final checkout. By analyzing the present industrial process, significant shortening of the cycle can only be obtained by having major sections of the total system, e.g., power-drives, receiver-regulators, sights, valve-blocks, cradles/trays, slides/rammers, transmitters, receivers, slip-ring assemblies, range-finders, etc., available for installation when the major system arrives at the depot. Thereby, reassembly can commence immediately after the system is torn-down and the system foundation and weather shield cleaned and preserved. Then, even if an equipment was not removed from the ship until after its arrival at the overhaul site, the reduced system industrial-time requirement would permit return of the item in adequate time to prevent overhaul delays.

This solution does not resolve the unforeseen replacement requirement problem however, and the Navy cannot afford to "not-have" a method to correct this shortcoming. OPNAVINST 4200.4B directs that spare systems or units thereof shall be programmed for procurement if: "non-availability of a spare system for replacement will seriously degrade the capability of a combatant unit to carryout the mission for which assigned." A review of Tab A denotes that only one gun system is installed on the FF-1052 Class, the DDG-31 through DDG-37, and the CG-26 Class. Further analysis reveals that wherein two or more mounts exist, only one fire-control system is installed. In the case of FFG and PHM Classes, only one 76MM gun mount and one fire-control system are installed. Operating under the premise that luck will prevail and major damage will not occur in over 300 gun systems installed in over 200 Fleet units for the next twenty-plus years is not backed by statistics.

ALTERNATIVES: The following alternatives are presented in ascending order of desirability:

(1) Buy total systems to fulfill battle spares requirements of OPNAVINST 4200.4B. This solution would require acquisition of one - Mk 42 Mod 9 mount, one - Mk 42 Mod 10 mount, two - Mk 45 Mod 0 mounts, two each - FCS Mk 68 and Mk 86. (Two spare 76MM Mounts are already programmed). This alternative would require an outlay of OPN and WPN of approximately $53 Million and would not resolve the problem of "not-ready-for-use" battle spares unless the equipments are periodically updated to Fleet baseline and refurbished to correct deterioration/cannibalization.

(2) Buy rotable pool major assemblies and battle spares. This solution could shorten depot turnaround time if the spare assemblies are not cannibalized of 6U Cog items (dedicated to GWSRP use), but the $53M outlay for battle spares, and the inherent problems of idleness, will remain a major problem.

(3) Buy sufficient subassemblies and build-up revolving battle spares. This solution would make use of programmed WPN procurements of 2J Cog gun system assemblies to expedite the industrial process at the depot and permit near "ready-for-use" battle spares. For example, if Fleet requirements are nine (9) Class A restored 5"/54 Mk 42 Mod 10 gun systems/year and OPNAVINST 4200.4B requires two (2) battle spares, then eleven (11) systems must be made available during year one. Thereafter, nine (9) Mod 10 systems would be inducted each year to fulfill continuing requirements. In effect, the extra two (2) items from year one become the revolving emergency replacement items. I.e., if the mount undergoing final checkout is needed for unforeseen requirements, it is available. If it is not required, it can be shipped early to the next scheduled Fleet installation. If it is needed for emergency requirements, the following year's production cycle requires ten (10) restorations to replace the used spare.

To accommodate current depot-asset shortages of gun fire-control systems only two system types, the FCS Mk 68 and FCS Mk 86, need be addressed at this time. In the case of FCS Mk 68, there are one-hundred six (106) Fleet installations which would require two (2) spare systems and ten (10) restorations per year. In that there are no spare equipments, initial requirements are twelve (12) during the first year and ten (10) per annum thereafter. For FCS Mk 86 weapon systems, wherein sixty-seven (67) Fleet installations are planned, above decks equipments and below deck consoles will require Class A restorations similar to those required by earlier fire control systems. Because there have been no spare major assembly OPN procurement thus far, initial outlay for 2J Cog items would have to be programmed for both systems.

RECOMMENDATION: Alternative (3) is the only viable solution to both problems; shortage of depot overhaul pipeline assets and emergent requirement spares can be resolved prior to FY 1987 if corrective action is effected now. This solution also resolves problems of battle spares deficiencies and battle spares degradation and permits compression of depot turnaround time to meet 1985-2000 Fleet requirements.

Some of the material necessary to get-started is currently in repository. For example, NAVSEASYSCOM has enough 5"/54 Mk 42 Mod 10 components to complete one (1) spare. Continued procurement of major assemblies through the WPN line until FY 1982 would permit assembly of an additional unit. The actual O&M,N funds to assemble/checkout these two equipments would be approximately $1,400,000. In the case of 5"/54 Mk 42 Mod 9, significant major assemblies have been procured, and gain, the necessary additional items for a complete equipment can be procured by FY 1982. Assembly/checkout of these systems will require $700,000 O&M,N in FY 1982. For 5"/54 Mk 45 systems, several of the major assemblies have been procured and additional items can be obtained in adequate time to begin overhaul in FY 1983. Assembly and checkout of these two systems will require an O&M,N expenditure of approximately $1,300,000 in FY 1983. Because the 76MM Mk 75 will be procured as battle spares, some deterioration can be expected by FY 1987. An O&M,N expenditure of $300,000 in FY 1987 will be necessary for checkout and minor refurbishment of these two systems.

Fire Control Systems Mk 68 and Mk 86 are a more difficult situation. It is recommended that procurement of 2J major assemblies of above decks Mk 86 and selected Mk 68 equipments be undertaken over a five-year OPN schedule as follows: FY'82 - $2,200,000; FY'83 - $2,400,000; FY'84 - $2,000,000; FY'85 - $1,500,000; and FY'86 - $1,500,000. Because these assemblies are procured as entities (e.g., Mk 39 Mod 0 antenna, SPQ-9A antenna, SPQ-9 radome, computers, consoles, etc.) no O&M,N assembly/checkout funding requirement is projected to "make-ready-for use."

Summarizing, a total outlay of less than $14,000,000 ($9,600,000 OPN and $3,700,000 O&MN),plus presently budgeted WPN funds can provide the necessary assets to correct the projected NAVSEASYSCOM gun weapon system restoration capacity/emergency replacement deficiency.

5"/54 POPULATION
INSTALLED MOUNTS

5"/54 Mk 42 & Mods

•FF

	GFCS Mk 68 Mod	MOUNT Mk 42 Mod 9	MOUNT Mk 42 Mod 10
FF-1052 VANCE	11		1
FF-1053 DAVIS	11	1	
FF-1054 GRAY	11	1	
FF-1055 HEPBURN	11	1	
FF-1056 CORONADO	14	1	
FF-1057 DAVIDSON	11	1	
FF-1058 BEVERIDGE	11	1	
FF-1059 W S.SIMS	11	1	
FF-1060 LANG	11	1	
FF-1061 PATTERSON	11	1	
FF-1062 WHIPPLE	11	1	
FF-1063 REASONER	11	1	
FF-1064 LOCKWOOD	11	1	
FF-1065 STEIN	11	1	
FF-1066 SHIELDS	11	1	
FF-1067 HAMMOND	11	1	
FF-1068 VREELAND	14	1	
FF-1069 BAGLEY	11	1	
FF-1070 DOWNES	11	1	
FF-1071 GARDNER	11	1	
FF-1072 OLIVELY	14	1	
FF-1073 PEARY	11	1	
FF-1074 HOLT	11	1	
FF-1075 TRIPPE	14	1	
FF-1076 FANNING	11	1	
FF-1077 ORELETT	11	1	
FF-1078 REVES	14	1	
FF-1079 BOWEN	14	1	
FF-1080 PAUL	13	1	
FF-1081 AYLWIN	13	1	
FF-1082 MONTGOMERY	13	1	
FF-1083 COOK	13	1	
FF-1084 McCANDLESS	13	1	
FF-1085 DONALD B. BEARY	13	1	
FF-1086 BREWTON	13	1	
FF-1087 KIRK	13	1	
FF-1088 BARBEY	13	1	
FF-1089 JESSE L. BROWN	13	1	
FF-1090 AINSWORTH	13	1	
FF-1091 MILLER	13	1	
FF-1092 THOMAS C. HART	13	1	
FF-1093 CAPODANNO	13	1	
FF-1094 PHARRIS	13	1	
FF-1095 TURETT	13	1	
FF-1096 VALDEZ	13	1	
FF-1097 ROBERTSON	13	1	
(40)		45	1

•DDG

	GFCS Mk 68 Mod	MOUNT Mk 42 Mod 3	MOUNT Mk 42 Mod 4	MOUNT Mk 42 Mod 7	MOUNT Mk 42 Mod 10	CONVERSION SCHEDULE Mod 10
DDG-2 ADAMS	4				2	
DDG-3 JOHN KING	4				2	
DDG-4 LAWRENCE	4			2		12/76
DDG-5 BARRETTS	4				2	
DDG-6 BARNEY	4				2	
DDG-7 WILSON	4				2	
DDG-8 McCORMICK	4				2	
DDG-9 TOWERS	4				2	
DDG-10 SAMPSON	4				2	
DDG-11 SEALERS	4				2	
DDG-12 ROBISON	4				2	
DDG-13 HOEL	4				2	
DDG-14 BUCHANAN	4				2	
DDG-15 BERKELEY	4				2	
DDG-16 STRAUSS	4				2	
DDG-17 CONYNGHAM	4				2	
DDG-18 SEMMES	4				2	
DDG-19 TATTNALL	4				2	
DDG-20 GOLDSBOROUGH	4				2	
DDG-21 COCHRANE	4				2	
DDG-22 STODDERT	4				2	
DDG-23 BYRD	4				2	
DDG-24 WADDELL	4				2	
DDG-31 DECATUR	9				1	
DDG-32 J.P. JONES	9			1		10/76
DDG-33 PARSONS	10			1		2/78
DDG-34 SOMERS	10				1	
DDG-35 MITSCHER	10A 67.1	1	1			
DDG-36 McCAIN	10A 67.1	1	1			
DDG-37 FARRAGUT	8				1	
DDG-38 LUCE	8			1		1/77
DDG-39 MACDONOUGH	8				1	
DDG-40 COONTZ	8			1		6/77
DDG-41 KIDD	8			1		9/78
DDG-42 MAHAN	8				1	
DDG-43 DAHLGREN	8			1		3/78
DDG 44 PRATT	8				1	
DDG 45 DEWEY	8				1	
DDG 46 PREBLE	8				1	
(39)		2	2	8	52	

•SHORE STATIONS

	Mod	MOUNT Mk 42 Mod 4	Mod 7	Mod 10
FTC DAM NECK, VA				1
NTC GREAT LAKES, IL			1	1
NTC SAN DIEGO, CA			1	1
NAVA DAHLGREN, VA		1		1
NOS LOUISVILLE, KY				1
(5)		1	2	5

•CG/CGN (GFCS Mk 68 0)

	MOUNT Mk 42 Mod 7	Mod 10	CONVERSION SCHEDULE Mod 10
CG-26 BELKNAP	1		11/77
CG-27 JOSEPHUS DANIELS		1	
CG-28 WAINWRIGHT		1	
CG-29 ARGETT		1	
CG-30 NORMI	1		9/77
CG-31 STERETT		1	
CG-32 STANDLEY		1	
CG-33 FOX		1	
CG-34 BIDDLE		1	
CGN-35 TRUXTON		1	
(10)	2	8	

•DD

	GFCS Mk 68 Mod	MOUNT Mk 42 Mod 7	Mod 10	CONVERSION SCHEDULE Mod 10
DD-931 SHERMAN	8	3		
DD-933 BARRY	8	2		
DD-937 DAVIS	1	2		
DD-938 INGRAM	1		2	
DD-940 HAWLEY	5	2		
DD-941 DUPONT	5		2	
DD-942 DIGELOW	5	3		
DD-943 BLANDY	5		3	12/76
DD-944 MULLINNIX	5	3		
* DD-945 HULL	3		2	
DD-946 EDSON	3		3	
DD-948 MORTON	3		2	
DD-950 EDWARDS	3		2	
DD-951 TURNER JOY	3		3	
(14)		16	18	

*1 MOUNT 8"/55 MK 71 MOD 0

•CVA (GFCS Mk 56 45)

	MOUNT Mk 42 Mod 7
CVA-61 RANGER	2
(1)	2

● Mk 42 Mod 7 10 CONVERSION

TYPE \ CY	CURRENT	76	77	78	79	TOTAL
CG/CGN	8		2			10
DD	16	2				18
DDG	52	4	2		2	60
FF	1					1
SHORE	5					5
TOTAL	82	6	4	0	2	94
CUM	82	88	92	92	94	

● Mk 42 POPULATION

TYPE \ MOD	3	4	9	7	10	7	10	TOTAL
CVA				2		2		2
CG/CGN				2	8		10	10
DD				17	16	15	18	33
DDG	2	2		8	52		60	64
FF			45		1		1	46
SHORE		1		2	5	2	5	8
TOTAL	2	3	45	31	82	19	94	183

AFTER CONVERSION

5"/54 Mk 45 Mod 0

•CGN

	GFCS Mk 68 Mod	DELIVERY SCHEDULE MOUNTS	DELIVERY SCHEDULE SHIP
CGN-36 CALIFORNIA	3 2	DEL	DEL
CGN-37 SOUTH CAROLINA	3 2	DEL	DEL
CGN-38 VIRGINIA	5 2	DEL	DEL
CGN-39 TEXAS	5 2	DEL	8/77
CGN-40 MISSISSIPPI	5 2	DEL	8/78
CGN 41	5 2	7/78	6/80
(6)	12		

•LHA (GFCS Mk 68 4)

	DELIVERY SCHEDULE MOUNTS	SHIP
LHA-1 TARAWA	3 DEL	DEL
LHA-2 SAIPAN	3 DEL	*
LHA-3 BELLEAU WOOD	3 DEL	*
LHA-4 NASSAU	3 DEL	*
LHA-5 DA NANG	3 *	*
(5)	15	

* DATES UNDER EVALUATION

•SHORE STATIONS

	DELIVERY SCHEDULE
FTC DAM NECK, VA	1 DEL
NTC GREAT LAKES, IL	1 DEL
NTC SAN DIEGO, CA	1 77
(3)	3

● Mk 45 ACTIVE MOUNTS by SHIP DELIVERY DATES

TYPE \ CY	CURRENT	76	77	78	79	80	TOTAL
CGN	6		2	2		2	12
DD	6	4	18	16	16		60
LHA	3		*6	*6			15
SHORE	2		1				3
TOTAL	17	4	27	24	16	2	90
CUM	17	21	48	72	88	90	

*SEE LHA NOTE ABOVE. DATES IN SUMMARY ARBITRARILY ASSIGNED TO COMPLETE TABLE.

•DD (GFCS Mk 86 3)

		DELIVERY SCHEDULE MOUNTS	DELIVERY SCHEDULE SHIP
DD-963 SPRUANCE	2	DEL	DEL
DD-964 PAUL F. FOSTER	2	DEL	DEL
DD-965 KINKAID	2	DEL	DEL
DD-966 HEWITT	2	DEL	9/76
DD-967 ELLIOT	2	DEL	11/76
DD-968 BADFORD	2	DEL	1/77
DD-969 PETERSON	2	DEL	3/77
DD-970 CARON	2	DEL	5/77
DD-971 DAVID RAY	2	DEL	7/77
DD-972 OLENDORF	2	11/75	7/77
DD-973 JOHN YOUNG	2	12/75	8/77
DD-974 COMTE DE GRASSE	2	1/76	9/77
DD-975 O'BRIEN	2	2/76	10/77
DD-976 MERRILL	2	3/76	11/77
DD-977 BRISCOE	2	4/76	1/78
DD-978 STUMP	2	5/76	3/78
DD-979 CONOLLY	2	6/76	4/78
DD-980 MOOSBRUGGER	2	7/76	5/78
DD-981 JOHN HANCOCK	2	8/76	7/78
DD-982 NICHOLSON	2	10/76	8/78
DD-983 JOHN ROGERS	2	11/76	9/78
DD-984 LEFTWICH	2	12/76	11/78
DD-985 CUSHING	2	1/77	1/79
DD-986 H.W. HILL	2	2/77	2/79
DD-987 O'BANNON	2	3/77	3/79
DD-988 THORN	2	4/77	4/79
DD-989	2	5/77	5/79
DD-990	2	6/77	6/79
DD-991	2	7/77	7/79
DD-992	2	8/77	8/79
(30)	60		

( ) NUMBER OF SHIPS/STATIONS

APPENDIX H

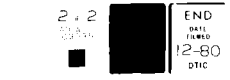
GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AAW	Antiair Warfare
AD	Destroyer Tender
ADP	Automatic Data Processing
AEI	Angle Error Indicator
AEL	Allowance Equippage List
AFS	Combat Store Ship
ALT	Alteration
AOE	Fast Combat Support Ship
AOR	Replenishment Oiler
APL	Allowance Parts List
ARC	Acquisition Review Counsel
ASROC	Anti-Submarine Rocket
ATS	Salvage and Rescue Ship
BOH	Baseline Overhaul
CASREP	Casualty Report
CD (or CRUDES)	Cruisers/Destroyers
CG	Guided Missile Cruiser
CGN	Guided Missile Cruiser (Nuclear)
CID	Component Identification Number
CIWS	Close-In Weapon System
CMP	Class of Maintenance Plan
CNO	Chief of Naval Operations
COG	Cognizance
COMNAVSEASYSCOM	Commander, Naval Sea Systems Command
COMNAVSURFLANT (PAC)	Commander, Naval Surface Forces Atlantic (Pacific)
CORS	Composite Operational Reporting System
CPU	Central Processing Unit
CSMP	Current Ship's Maintenance Project
CSO	Combat Systems Office
CSRR	Combat Systems Readiness Review
CSRT	Combat Systems Readiness Test
CY	Calendar Year

DD	Destroyer
DDEOC	Destroyer Engineered Operating Cycle
DDG	Guided Missile Destroyer
ECP	Engineering Change Proposal
ECR	Equipment Condition Report
EIC	Equipment Identification Code
EOC	Engineered Operating Cycle
EP	Electronic Panel
ERC	Equipment Replacement Code
ESL	Estimated Service Life
FCS	Fire Control System
FF	Frigate
FFG	Guided Missile Frigate
FMP	Fleet Modernization Program
FROGS	Fleet Report of Gun Systems
FSN	Federal Stock Number
FTC	Fleet Training Center
FY	Fiscal Year
GFCS	Gun Fire Control System
GFE	Government Furnished Equipment
GSED	Gun System Engineering Department NOSL
GWS	Gun Weapon System
GWSIP	Gun Weapon System Improvement Program
GWSRP	Gun Weapon System Replacement Program
HM&E	Hull, Mechanical, and Electrical
IAW	In accordance with
ILS	Integrated Logistics Support
IMA	Intermediate Maintenance Activity
INSURV	Inspection and Survey
ISEA	In-Service Engineering Agent
LHA	Amphibious Assault Ship
LKA	Amphibious Cargo Ship
LPD	Amphibious Transport Dock
LPH	Amphibious Assault Ship
LSD	Landing Ship Dock
LST	Landing Ship Tank
MAG	Marine Corps Air Group
MCL	Material Condition Level
MCR	Material Condition Review
MDS	Maintenance Data System
MIS	Management Information System
Mk	Mark
MLSF	Mobile Logistics Support Force
Mod	Modification

MOTU	Mobile Technical Unit
MRC	Maintenance Requirement Card
MTBF	Mean Time Between Failures
NALCOMIS	Naval Aviation Logistics Command Management Information System
NAVELEX	Naval Electronics System Command
NAVORDSTA	Naval Ordnance Station
NAVSEA	Naval Sea Systems Command
NAVSEACEN	Naval Sea Support Center
NAVSEC NORDIV	Naval Ship Engineering Command, Norfolk Division
NAVSUPSYSCOM	Naval Supply Systems Command
NAVWPNSTA	Naval Weapons Station
NOS	Naval Ordnance Station
NOSIH	Naval Ordnance Station, Indian Head
NOSL	Naval Ordnance Station, Louisville
NSY	Naval Shipyard
NTC	Naval Training Center
NWPSTA	Naval Weapon Station
NWSC	Naval Weapon Support Center
OA	Ordnance Alteration
O&MN	Operations and Maintenance, Navy
OIP	Ordnance Improvement Plan
OP	Ordnance Publication
OPN	Other Procurement Navy
OPNAV	Office of the Chief of Naval Operations
OrdAlt	Ordnance Alteration
ORL	Overhaul Replacement List
OVHL	Overhaul
PASS	Pay and Personnel Administrative Support System
PEOC	Amphibious Engineered Operating Cycle
PERA	Planning and Engineering for Repairs and Alterations (ASC) - Amphibious Ships and Craft, Norfolk NSYD (CD) - Cruisers/Destroyers, Philadelphia NSYD (CSS) - Combat Support Ships, NAVSEA Industrial Support Office (NISO) San Francisco (CV) - Aircraft Carriers, etc., Puget Sound NSYD (SS) - Submarines, Portsmouth HSYD
PHM	Patrol Combatant Missile (Hydrofoil)
PMS	Planned Maintenance System
POA&M	Plan of Action and Milestones
POT&I	Preoverhaul Test and Inspection
QA	Quality Assurance
RAV	Restricted Availability
RMMS	Repair Maintenance Management System
ROH	Regular Overhaul
RSPE	Radar Signal Processing Equipment

AD-A090 952 AKINC RESEARCH CORP ANNAPOLIS MD F/G 19/6
TECHNICAL AND MANAGEMENT SUPPORT FOR THE GUN WEAPON SYSTEM REPL--ETC(U)
AUG 80 N LAKIS N00174-79-C-0340
UNCLASSIFIED 1665-01-2254 NL



OF 2

D A
90952

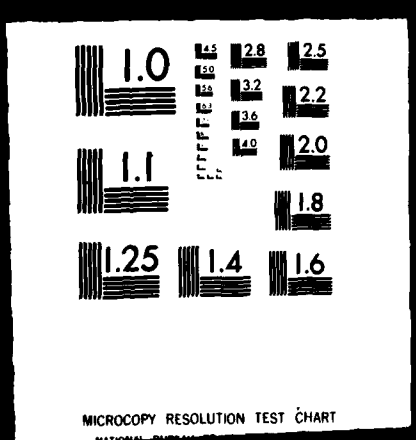
SARP
SECAS
SIMA
SM&R
SMA
SNAP
SPCC
SRA
SUPSHIP
SUW
SYSCOM

TDT
TYCOM

VAMOSC

WPN
WQEC

XEOC



SARP	Ship Alteration and Repair Package
SECAS	Ships Equipment Configuration Accounting System
SIMA	Shore-Based Intermediate Maintenance Activity
SM&R	Source Maintenance and Recoverability
SMA	System Maintenance Analysis
SNAP	Shipboard Non-Tactical ADP Program
SPCC	Ships Parts Control Center
SRA	Selected Restricted Availability
SUPSHIP	Supervisor of Shipbuilding, Conversion, and Repair
SUW	Surface Warfare
SYSCOM	Systems Command
TDT	Target Designation Transmitted
TYCOM	Type Commander
VAMOSC	Visibility and Management of Support Costs
WPN	Weapon Procurement Navy
WQEC	Weapons Quality Evaluation Center
XEOC	Auxiliary Engineered Operating Cycle